

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 14

San Francisco, January, 1928

Number 1



COMMERCIAL FISHERIES NUMBER

DEPARTMENT OF NATURAL RESOURCES.

DIVISION OF FISH AND GAME.

Sacramento, California.

Fish and Game Commission appointed by the Governor. Term at pleasure of Governor. No compensation.

I. ZELLERBACH, President	San Francisco
GEORGE B. CLARKSON, Commissioner	Los Angeles
REGINALD S. FERNALD, Commissioner	Santa Barbara
EUGENE D. BENNETT, Executive Officer and Attorney	San Francisco
Mrs. P. A. Ford, Secretary to Commission	San Francisco
J. S. Hunter, Assistant to Executive Officer	San Francisco
Ralph W. Scott, Assistant Attorney	San Francisco
Postal Telegraph Building, San Francisco. Phone Sutter 6100.	

DEPARTMENT OF FISH CULTURE.

W. H. SHEBLEY, Director	Sacramento
E. W. Hunt, Field Superintendent	Sacramento
G. H. Lambson, Superintendent Mt. Shasta Hatchery and Klamath River Stations	Mt Shasta
E. V. Cassell, Foreman in Charge Fall Creek Hatchery	Copco
Guy Tabler, Foreman in Charge Yosemite and Wawona Hatcheries	Yosemite
C. L. Frame, Foreman in Charge Brookdale Hatchery	Brookdale
J. C. Lewis, Foreman in Charge Fort Seward Hatchery	Alderpoint
J. W. Ricker, Foreman in Charge Ukiah Hatchery	Ukiah
J. Shebley, Foreman in Charge Feather River Hatchery	Clio
Ed. Clessens, Foreman in Charge Kaweah Hatchery	Hammond
Geo. McCloud, Superintendent Mt. Whitney Hatchery	Independence
Geo. E. West, Superintendent Tahoe Hatchery	Tahoe
F. F. Anderson, Superintendent Domingo Springs Hatchery	Westwood
D. A. Clanton, Foreman in Charge Bear Lake Hatchery	Pine Knot
F. B. Hamer, Foreman, Mormon Creek Experiment Hatchery	Sonora
L. W. Strauss, Foreman, Burney Creek Hatchery	Burney
J. H. Vogt, Kern River Hatchery	Kernville
L. Phillips, Superintendent of Car No. 01	Mt. Shasta
Ross McCloud, Superintendent of Car No. 02	Mt. Shasta

DEPARTMENT OF COMMERCIAL FISHERIES.

N. B. SCOFIELD, Director	San Francisco
B. D. Marx Greene, Attorney	San Francisco
H. B. Nidever, Supervising Captain	Terminal Island
S. H. Dado, Supervising Captain	San Francisco
R. F. Classie, Captain	Monterey
Coburn F. Maddox, Captain	San Diego
W. L. Scofield, Acting Director State Fisheries Laboratory	Terminal Island
W. F. Thompson, Consultant, State Fisheries Laboratory	Terminal Island

COMMERCIAL FISHERIES PATROL.

F. P. Bacon	Terminal Island	Ross W. Markley	Pismo
Paul Bonnot	San Francisco	Tate F. Miller	Terminal Island
N. C. Kunkel	Terminal Island	L. G. Van Vorhis	Pittsburg

LAUNCH PATROL.

Walter Engelke	Launch "Albacore,"	San Pedro
M. M. Tritch	Launch "Albacore,"	San Pedro
C. A. Crosbie	Launch "Steelhead,"	Monterey

BUREAU OF FINANCE AND ACCOUNTS.

H. R. DUNBAR, Assistant Executive Officer and in Charge	Sacramento
---	------------

BUREAU OF EDUCATION.

DR. H. C. BRYANT, Director	San Francisco
Rodney S. Ellsworth, Assistant	San Francisco

BUREAU OF PUBLIC RELATIONS.

FRANK H. VORE, Director	San Francisco
-------------------------	---------------

BUREAU OF HYDRAULICS.

(Screens, Ladders and Pollution.)

JOHN SPENCER, In Charge	San Francisco
Clarence Elliger, Assistant	San Francisco

BUREAU OF GAME FARMS.

AUGUST BADE, Superintendent	Yountville
-----------------------------	------------

BUREAU OF RESEARCH.

R. E. LUDLUM, Director	San Francisco
Robt. J. Irvine, Chemist	San Francisco

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION."

Volume 14

SACRAMENTO, JANUARY, 1928

Number 1

CONTENTS.

	Page
THE SEA LIONS OF CALIFORNIA.....	Paul Bonnot 1
THE SMELTS OF THE SAN PEDRO WHOLESALE FISH MARKETS.....	
.....	Frances N. Clark 16
HOW A NATURAL RESOURCE IS BEING ADMINISTERED.....	W. L. Scofield 21
SALMON INVESTIGATION.....	J. O. Snyder 25
STRIPED BASS STUDIES.....	E. C. Scofield 29
CATCH FIGURES AND FISH SUPPLY.....	Joe A. Craig 37
AN HISTORICAL REVIEW OF THE LEGAL ASPECTS OF THE USE OF	
FOOD FISH FOR REDUCTION PURPOSES.....	B. D. Marx Greene 42
BIOLOGICAL REQUISITES FOR LAKE TROUT.....	George A. Coleman 45
PROGRESS IN HALIBUT INVESTIGATIONS.....	Ruth Miller Thompson 47
EDITORIALS.....	50
COMMISSION ACTIVITIES.....	72
COMMERCIAL FISHERY NOTES.....	83
LIFE HISTORY NOTES.....	89
CONSERVATION IN OTHER STATES.....	93
REPORT ON SARDINE CANNERIES, 1926-27.....	95
REPORTS—	
Violations of Fish and Game Laws.....	98
Statement of Income and Expenditures.....	99
Fishery Products, July to September, 1927.....	102

THE SEA LIONS OF CALIFORNIA.

By PAUL BONNOT.

(With eight photographs and two maps by the author.)

Most of the larger mammals of California have been extensively studied. As a result of these studies, a few have been reduced to the point of extermination because it has been shown that they are detrimental to man. The majority, however, are protected by law as they do not conflict with man's commercial pursuits, and in some cases are rated as beneficial. The sea lions have not been studied to any extent

and very little is known about them. Nevertheless, determined efforts have been made from time to time to exterminate them. Late in 1926, the fishing industries complained to the Fish and Game Commission regarding the depredations of the sea lions, and asked that their numbers be reduced. The writer was detailed by Mr. N. B. Scofield, head of the Department of Commercial Fisheries of the Division of Fish and Game, to make a survey of the marine mammals of the state, to investigate the claims made by the fishermen and to determine the present status of these animals. This survey will be continued for several years. This year's work has resulted in a great deal of authentic data and several interesting conclusions, some of which are dealt with in the present article.

There are two species of sea lions found on the coast of California:

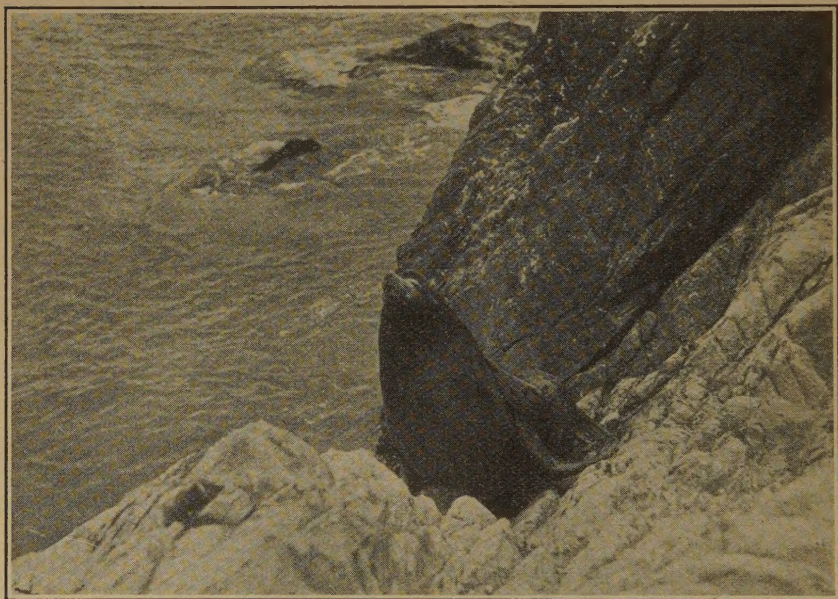


FIG. 1. An adult bull California sea lion at Flea Island. This animal seemed unafraid of the photographer. June 13, 1927.

Steller's sea lion (*Eumetopias stelleri*) and the black or California sea lion (*Zalophus californianus*).

Steller's sea lion is found from Bering Sea to Santa Cruz Island. The breeding range is from Bering Sea to Santa Rosa Island. They are found the year round throughout their range, though the bulls, for the most part, disappear during the winter and spring. The general opinion seems to be that the bulls migrate to Alaska during this time. The animals are light gray in color when wet, which turns to light brown when dry. The bulls are much larger than the cows. A full-grown bull will weigh between 1500 and 2000 pounds, while the cows will weigh between 600 and 1000 pounds.

The California sea lion is found from the Farallon Islands south to central Mexico. The breeding range is from Point Piedras Blancas to an unknown point in Mexico. In the past, the California sea lion

was fairly abundant and probably maintained rookeries as far north as the Farallons. They have been recorded as far north as Puget Sound. At the present time, they are rare north of Point Piedras Blancas, in San Luis Obispo County. The California sea lion is dark brown in color when wet, and an ochre yellow or brown when dry. The bulls weigh from 800 to 1000 pounds, and the cows from 500 to 700 pounds. The skull of the bull has a high keel which gives the profile of the face a concave outline.

Sea lions are polygamous animals, one bull generally taking care of from five to twenty cows. They begin to collect on the rookeries during May. The pups are born from June to the middle of July. They must be taught to swim and are generally not proficient in the water for about six weeks. By the end of August or middle of September, the bulls leave and the rookery is broken up. A few animals may be found on the regular rookeries at all times.

Some General Habits of Sea Lions. As sea lions pass most of their lives in the water, they would naturally be expected to be fine swimmers. In the water the front flippers are used for swimming, the hind ones trailing behind. They can swim readily on either the belly, sides or back. A favorite method of progression seems to be to rotate slowly on the long axis. I have seen yearlings jump clear of the water, make a graceful arc and go in head first, like a porpoise. I have never seen an adult do this. Mr. N. B. Scofield tells me he has seen adult sea lions, at the mouth of the Klamath River, riding the surf in the same manner as men using surf boards. The animals repeated this again and again, and were evidently doing it for amusement. The adults, when landing on a steep bank, will sometimes shoot up from a wave as much as five or six feet. In moving on land they are clumsy, yet they can move with surprising speed. The front flippers are used as a base, the hind ones drawn under and the animal springs forward on them, the front flippers being hitched forward at the same time. They will dive into the water from considerable heights; and I once saw a Steller bull leap from a rock down ten or twelve feet to a gravel beach, where he landed on his chest and continued his course to the water, apparently none the worse.

Sea lions can see a moving object very well, but do not seem to clearly see a stationary object. I have on several occasions stood or sat in full view, using my glasses and making notes, and no notice was paid to me by animals thirty or forty feet away. When I started to move off or rose to my feet, however, nearly every animal in sight saw me at once.

They do not seem to have a very keen sense of smell. They use this sense as a means of identifying one another, as do dogs, but give little indication that it is useful for distant odors.

Their hearing is also rather poor. On several occasions I have walked up to blind animals, taking no particular pains to remain quiet, and though they seemed to sense my presence, it did not seem to be through the sense of hearing.

On the hauling grounds and rookeries, the sea lions practice no sort of sanitation, as do some animals. The places frequented by them are rocky and uneven, and therefore catch debris, such as excreta and dead animals. These are trampled underfoot and left. In consequence,

a sea lion rookery is very dirty underfoot and, at close range, very evident to the olfactory nerve.

Sea lions are both diurnal and nocturnal. It is not easy to observe their comings and goings at night but, from the continual uproar, they are as active by night as by day. When on the rookeries at the breeding season, they seem to spend a great deal of their time sleeping on the rocks. At other seasons they move up and down the coast a short distance, swimming in small schools and fishing. On two occasions I watched several fishing at night, their movements being easily followed by the line of phosphorus in the water, and their loud "whosh" when they came up to blow.

At Ano Nuevo the rookeries seem to be conducted as are the rookeries of the fur seal. That is, a large bull, by right of might, collects a

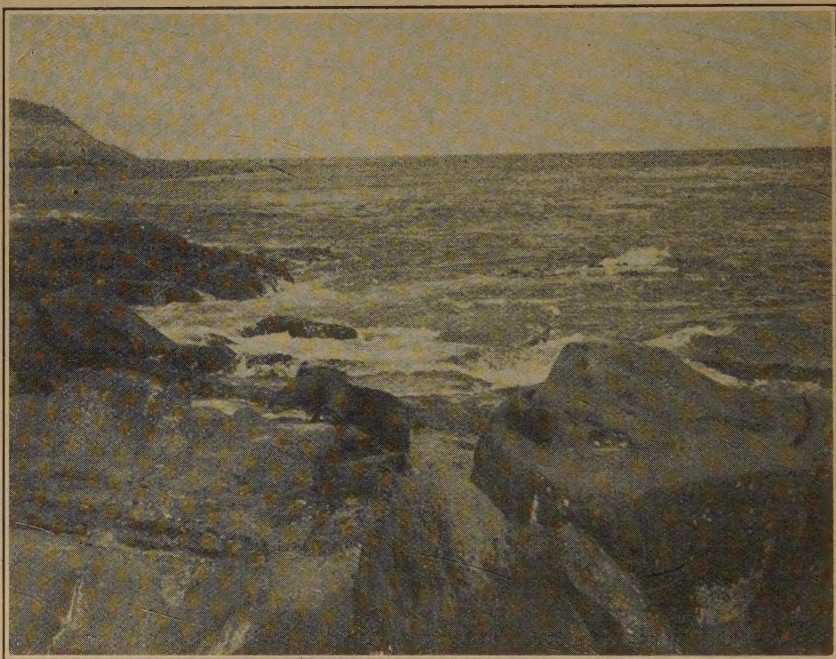


FIG. 2. A blind, young bull California sea lion at Point Bennett. Blindness is occasionally encountered and may be counted a natural check on abundance. June 10, 1927.

varying number of cows, drives off all other bulls and manages his "harem" himself. He will fight desperately for his small piece of territory or to retain his cows, maintaining his stand for the whole breeding season, not even leaving to eat. At all other rookeries I visited, however, this does not apply. I saw no evidence of the so-called harems. The bulls, old and young, were mixed up indiscriminately on the rookeries. There was little or no fighting. I saw only one California bull who was cut about the chest as though he had been fighting. The nearest approach to fighting was a more or less continual wrangling among the cows, which, though noisy, seemed never to go beyond the point of making a few passes at each other.

In this regard, it might be well to mention that the Ano Nuevo rookery is unique in another way. The animals there are evidently more used to man and have enjoyed protection for so long that they do not act toward him as at other places. At all other places it was necessary to "sneak" up to the animals in order to count and observe them; but at Ano Nuevo, although most of the cows and some of the bulls will "unload" upon the appearance of a man, the big herd bulls will not only stand their ground but will actually chase a man who gets too close. Generally, they will not press the matter, but as they look as big as an ox and weigh close to 2000 pounds, it behooves the investigator to respect their dignity and give them room.

The cows will sometimes form what are known as "rafts." They lie together in the water in small or large bunches, apparently asleep, swinging with the action of the water. Here and there in the compact group a flipper will be elevated. The rafts seem to be formed by cows nearing the pupping time. Each cow has but one pup a year. The pup can not swim for several weeks after birth, but even when first born, it has a natural instinct for the water. I have seen a young pup go overboard and get a mauling from the breakers but, upon stranding on the beach, half-drowned, it not only met my attempts to help with a defiant squall but plunged back into the next wave. On such occasions they desperately work their flippers up and down, but until the use of the flipper is learned and breathing is coordinated, they are more helpless in the water than the average terrestrial animal. The bulls pay no attention whatever to the pups, and the cows seem only interested in their own. I have several times seen a bull, while stampeding or love-making, step on a pup that happened to be in the way, and its frantic squalls were lost in the uproar of the occasion. The cows seem to know their own pups, and when coming ashore will hunt their own. Another's pup, however, is treated rather roughly. I have seen a cow pick up a pup in her mouth and throw it at least 10 feet with a vicious side jerk of her head. On two occasions, while examining and photographing pups, a cow called just outside the breaker line. Her call sounded exactly like an ordinary domestic cow calling her calf. The pup, at my feet, evidently recognized the cow, as it stiffened up and answered the call with a high-pitched squall.

Sea lions are gregarious animals but I would not call them social. They ordinarily travel about in small groups, and collect, of course, in large numbers on the rookeries; but they seem to conduct themselves toward their fellows on a strict *laissez faire* basis. When lying about on shore, there is a continual snarling and growling and if, in moving about, one animal happens to tread on another there is at once an uproar. These disturbances seldom amount to anything, but there is little that is amiable about them.

There seems to be little or no definite communication among sea lions. Mr. Alvin Seale, of the Steinhart Aquarium, first called my attention to the fact that they seem to communicate by touching their noses together. The sea lions at the aquarium do this. I watched for it on the rookeries and saw it many times. Each animal has, no doubt, a definite scent, and they either use this habit of touching noses as a means of identification, as everyone has seen dogs do, or there may be a more definite exchange of ideas. At Seal Harbor, San Clemente

Island, I saw a half-drowned pup, squalling and splashing a hundred feet from the beach. Several cows swam up to it, touched its nose and then, evidently finding it not their own, went on their respective ways and left it. Evidently its own mother was beyond the sound of its call, as its cries went unheeded until it drowned.

Each species has several distinctive calls but none of them seems to convey much intelligence to other members of the same herd. After stampeding into the water when alarmed by a landing party, the animals swam up and down the rookery, just outside the breakers, roaring or barking, according to the species. There were generally several individuals too sleepy or too lazy to leave with the herd, and these paid no attention whatever to the loud uproar kept up by their fellows in the water. They only departed, in great haste, when touched.



FIG. 3. Sea lion pups after a little handling become fairly tame. Gull Island. June 14, 1927.

Once, several of us sneaked up on a sleeping bull, the photographer focused his camera, and then with a touch of the foot, the bull was awakened to furious haste.

The call of the Steller sea lions consists of a deep, hoarse roar. Both sexes have this, the bull's roar being deeper and louder. The cows "baa" for the pups, and the pups answer with the same sound, about two octaves higher.

The California sea lions make a "honking" bark, repeated steadily. They also make a smooth howl that sounds exactly like a hound. The cows and pups call as do the Stellers.

Both species snarl and growl when angry or frightened. When suddenly awakened from a sound sleep and finding themselves sur-

rounded by several men, both species of all ages emit a loud, quavering "Ah" of surprise and fear.

In captivity, sea lions do very well. They are docile, intelligent and fairly hardy. They are subject, to some extent, to pulmonary disorders. The cows only are used for exhibition purposes and for performing acts. These are, for the most part, California cows, but occasionally a Steller cow is put on exhibition. The bulls are too large and pugnacious to be readily handled. California bulls have been taken but an adult Steller bull has never been captured.

The impression of the rookeries most vividly remembered is the continual uproar of sound. This is seldom or never absent. While on the rookery, talking in an ordinary tone of voice is heard with difficulty. The sound ebbs and flows like the roar of the surf, with here and there a sudden breaking through of sharper sound by some individual that happens to be close at hand or that has been trodden on by one of its fellows and voices its protest.

History of Sea Lions in California. Before 1860, sea lions were extremely numerous along the California coast. During the sixties, they were commercially valuable and their numbers therefore steadily decreased until the late seventies, when the products gained from them (oil and hides) were bringing such a low price that it was unprofitable to hunt them.

Scammon, in 1874, says, "A few years ago great numbers of sea lions were taken along the coast of upper and lower California, and thousands of barrels of oil obtained. The number of seals slain exclusively for their oil would appear fabulous when we realize the fact that it requires, on an average, throughout the season, the blubber of three or four sea lions to produce a barrel of oil. Their thick, coarse-grained skins were not considered worth preparing for market, in a country where manual labor was so highly valued. At the present time, however, they are valuable for glue stock, and the seal hunter now realizes more comparative profit from the hides than from the oil."

In 1899, the sea lion question in California became acute. At the behest of the fishing industries, the Fish and Game Commission called a meeting in San Francisco to discuss the situation and to decide on a course of action. The fishing industries were represented and several scientific men attended. The conclusions arrived at by this conference were that the sea lions were too numerous, that they were destructive to the fishing industries and that their numbers should be reduced. As most of the large rookeries were located on lighthouse reservations, the Commissioners wrote to the Honorable Lyman Gage, Secretary of the Treasury, for permission to kill sea lions on the federal lighthouse reservations. This request was granted on April 27, 1899. The Commission sent two men to the Farallone Islands and two to Ano Nuevo Island, both lighthouse reservations, but before any killing had been done the permission was revoked by wire, on May 31st.* On June 9th, a letter from the Treasury Department gave the information that the suspension was due to protests from the United States Fish Commission, the Secretary of the United States Department of Agriculture,

* Mr. Walter Welch, Field Agent for the Fish and Game Commission, tells me that in 1899 he was a deputy for the Commission in Santa Cruz County and that before the Lighthouse Board canceled the permission to kill sea lions on the reservation, several thousand were killed at Ano Nuevo.

the New York Zoological Society and various others. The California Commission stated its case at greater length, and the United States Commissioner of Fisheries withdrew his opposition. The other protestants, however, could not be induced to withdraw their opposition and the Lighthouse Board refused to cancel the suspension.

While this controversy was at its height, in the summer of 1899, Professor L. L. Dyche, of the University of Kansas, made examinations of sea lion stomachs at Monterey and found only squid contained therein, although at the time salmon and other fish were plentiful in the bay. Dr. C. H. Merriam, in *Science*, May 17, 1901, uses this work of Dyche's in an article in support of the contention that the sea lions are not detrimental to the fishing industry.

In 1900, the Lighthouse Board still refusing to grant permission to kill sea lions on the federal reservations, the California Commission asked for the appointment of a special commission to investigate the matter thoroughly. This commission was appointed. It consisted of Cloudsley Rutter, chairman; R. E. Snodgrass, named by the California Fish and Game Commission, and E. C. Starks from the California Academy of Sciences. This commission studied the sea lions in California and its findings were published in the Commissioner's Report of the United States Commission of Fish and Fisheries for 1902. They came to the conclusion that little damage was done to fishing gear by the sea lions. In regard to food, they arrived at the conclusion that the Steller sea lion is largely a fish consumer and the California sea lion is largely a squid eater. "It seems apparent, however, that either species feeds on whatever is most convenient."

Although the California Commission could not kill sea lions on the federal reservations, they were so confident of the correctness of their stand that several of their deputies were ordered to hunt sea lions and a great many were killed. Their report of 1901-1902 states, "The action of this Commission in causing a reduction of the sea lion herds, the killing of which was carried on for a few weeks in the spring of 1899, also in 1900, because of the inroads made on the supply of food fish, particularly salmon, has been the subject of more or less newspaper criticism. It arose chiefly from the groundless fear that one of the picturesque features of San Francisco, the Seal Rocks, would be destroyed.* When our methods, scene of operation, and reasons therefore were made known, the criticism quickly subsided. Though no seals have been killed for more than two years, it is a fact that not since that time have they been seen in any numbers in the bays and rivers, and complaints about damage to nets and taking of fish have been very infrequent."

Between 1902 and 1909 little was heard of the sea lions. Captain H. B. Nidever, of San Pedro, has supplied me with the information that in 1907 and 1908 several men systematically hunted sea lion bulls at San Miguel Island and killed practically all the bulls of breeding age.

In 1909 the sea lions had been so reduced that several natural history societies and interested parties sponsored a bill for their protection, "forbidding the killing, maiming or capturing of sea lions in the waters

* Mr. John Rowley, of the Los Angeles Museum, has in his possession a picture taken in 1889 which shows a flourishing rookery of Steller sea lions on the Seal Rocks at San Francisco. This place is and has for a long time been only a hauling ground.

of Santa Barbara channel and on land adjacent thereto, or in fish and game district nineteen." This was primarily to prevent the extermination of the California sea lion.

Since 1909 there has been no organized killing, though a small but steady drain has been acting on the herds. Several individuals add to their incomes by killing the breeding bulls for the penis and testicles, known to the trade as "trimmings." These are sold to the Chinese, who manufacture a medical preparation supposed to rejuvenate the aged. A number of California sea lions are taken annually to be used for exhibition purposes in zoological gardens and circuses. This species is used almost exclusively, as the Steller is too large and difficult to handle.

In 1927 the fishing interests of San Pedro and Santa Barbara sponsored a bill (Senate Bill No. 547, introduced by Senator Charles W.



FIG. 4. Bull sea lion trimmings hung up to dry on San Miguel Island. When dried they are sold to the Chinese who manufacture from them a medical preparation supposed to rejuvenate the aged. June 16, 1927.

Lyon, of Santa Barbara), which would have repealed section 637c of the Penal Code, the law of 1909. If this had passed, it would have taken all protection from the sea lions in California. This was subsequently withdrawn. Another bill (Assembly Bill No. 820, introduced by Assemblyman Morgan Keaton, of Long Beach) would have given the Fish and Game Commission power to control the seals and sea lions "where it determined such reduction was necessary." This also was withdrawn. A third bill relating to sea lions (Assembly Bill No. 199, introduced by Assemblyman T. R. Finley, of Santa Barbara), which passed both houses and was signed by the Governor May 17, 1927, affords protection to the California sea lion only, in fish and game

districts 19, 20 and 20A. This is approximately the same territory covered by the old law, but is more definite as to boundaries and includes Catalina Island, which was not in the previous law. This law became effective July 29, 1927.

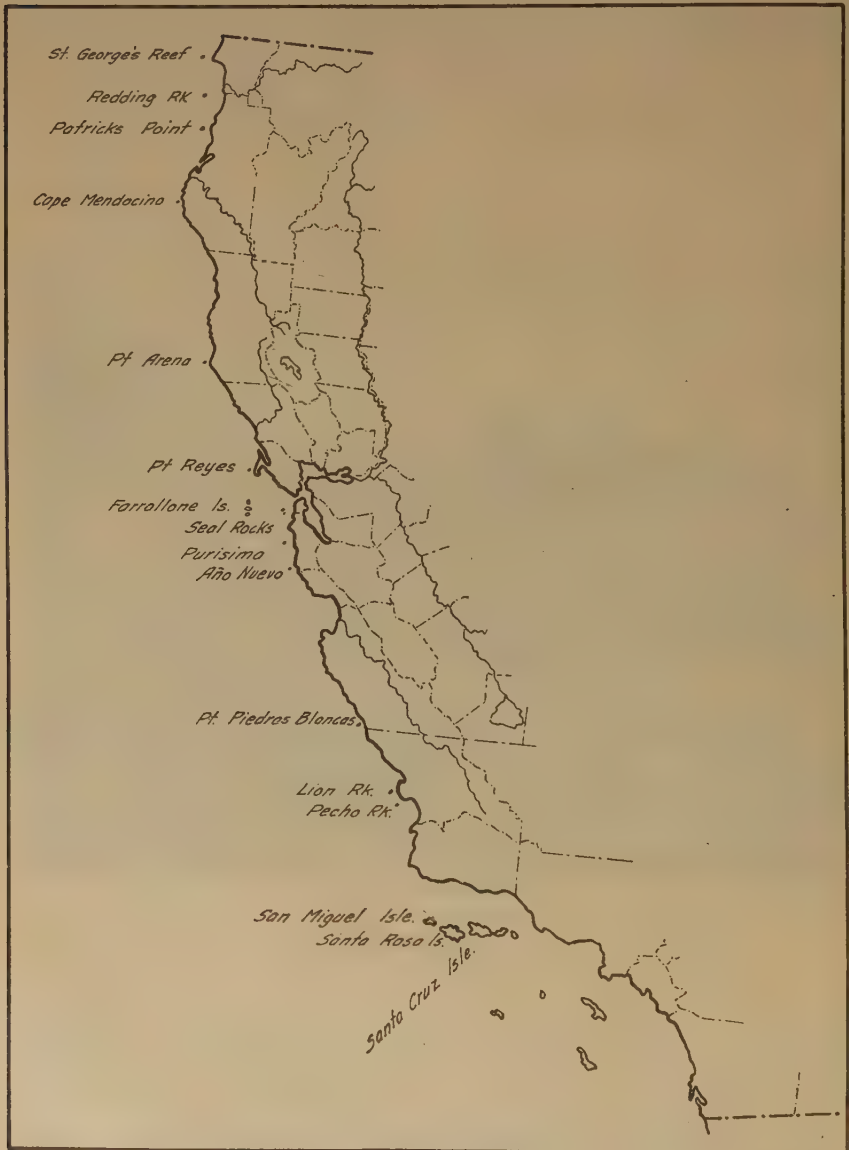


FIG. 5. Rookeries and hauling grounds of the Steller sea lion, *Eumetopias stelleri*, on the coast of California.

For the last twenty years, the information concerning sea lions has been confined to short notes by scientific men and to complaints of fishermen. The scientific man, with little authentic data, is cautious

when expressing an opinion. The fisherman, however, talks of thousands, and a vast amount of damage. The facts show that the numerical strength of the sea lion herds has been greatly exaggerated. The fol-

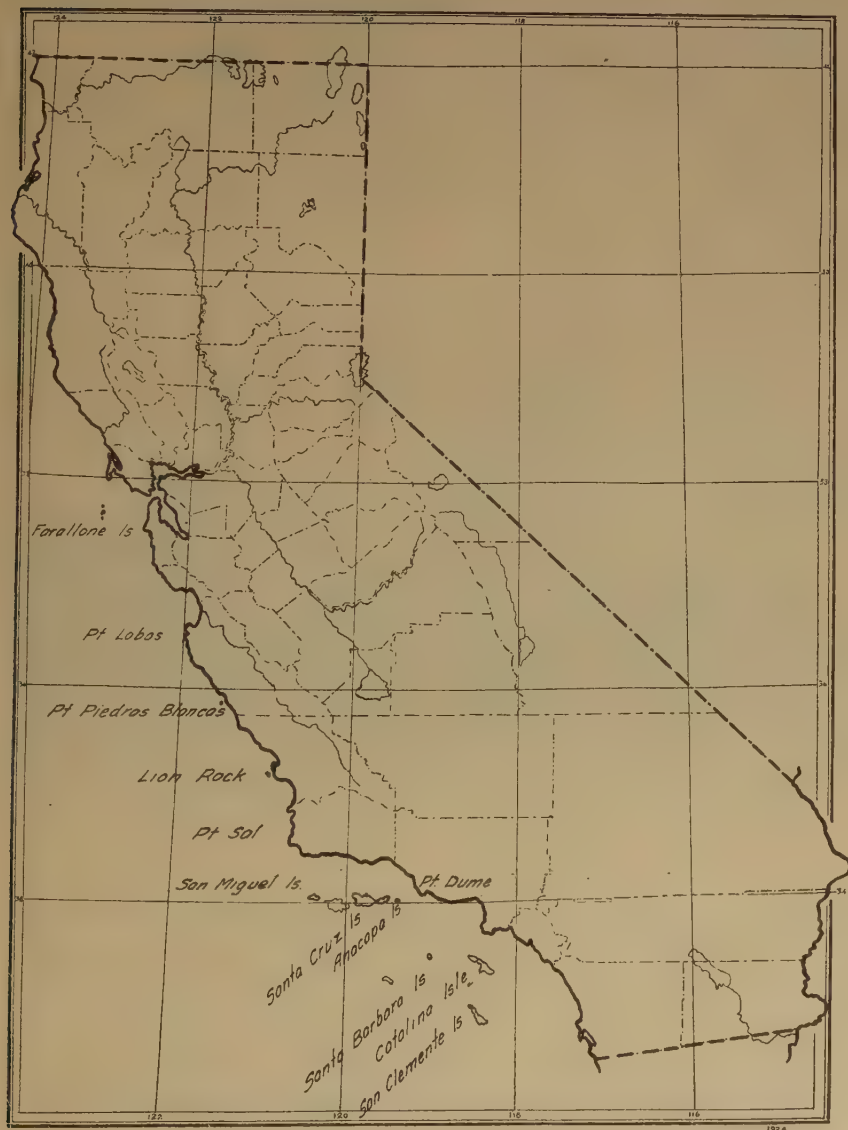


FIG. 6. Rookeries and hauling grounds of the California sea lion, *Zalophus californianus*, on the coast of California.

lowing maps and table will show more clearly than a written explanation the present status of population of the sea lions:

<i>Rookery</i>	<i>Steller</i>	<i>California</i>
St. George Reef	1500	---
Redding Rock	200	---
Patrick's Point	200	---
Cape Mendocino	700	---
Point Arena	300	---
Point Reyes	15	---
Farallon Islands	700	6
Purisima	150	---
Año Nuevo	1500	---
Point Piedras Blancas	212	86
Lion Rock (San Luis Obispo County)	86	21
Pecho Rock	135	7
Point Sal	---	10
Point Dume	---	11
Point Bennett	31	42
Offshore Rock	41	---
Lion Rock	8	---
Flea Island	275	107
Richardson Rock	199	---
Wilson Rock	41	---
Sandy Point	49	---
Frazer Point	2	63
Gull Island	18	145
Tyler Bay	---	5
Anacapa Island	---	34
Santa Barbara Island	---	125
Catalina Island	---	15
Castle Rock	---	29
Seal Harbor	1	235
Totals	6363	941

Point Bennett, Offshore Rock, Lion Rock, Flea Island, Richardson Rock and Wilson Rock are located about the west end of San Miguel Island. Sandy Point is at the west end of Santa Rosa Island. Frazer Point and Gull Island are at the west end of Santa Cruz Island. Castle Rock is at the southwest end of San Clemente Island, and Seal Harbor lies on the south side of San Clemente.

Present Economic Status. That the sea lions eat fish is, I think, a statement which few men at present will question. There is no doubt in my own mind that they do eat fish. They also eat squid and octopii, crustacea and "occasionally birds."* The fact that the sea lions eat fish does not seem to me to carry a great amount of weight in contending that they should be destroyed. Their fish diet is not confined to any one species. They eat, indiscriminately, commercially valuable fish and worthless ones. Having such a catholic taste, they destroy quantities of such fish as dogfish and morays, mollusks such as squid and octopii, and crustacea such as deep-water crabs which have little or no commercial value. The dogfish, morays and octopii are predacious and interfere to a greater or lesser extent with commercial fishing, having little commercial value themselves.

The sea lions may also be holding in check organisms of which we know nothing, which, if allowed to develop unchecked, through the

* I am rather skeptical in regard to this bird-eating habit, as I have seen no indication of it. Some of the sea lion rookeries are on rocks which also support large bird rookeries. The bird rookeries are close to, and easily accessible to, the sea lions, but I have seen nothing that would indicate that the sea lions ever raided them.

extermination of the sea lions, might be far more destructive to fishing than the sea lions are at present, and a great deal more difficult to deal with.

The fishing industries are not, at the present time, suffering from the depredations of the sea lions to such an extent that any extensive reduction in their numbers is necessary.

Natural Enemies of Sea Lions. Sea lions have a number of natural checks on their increase acting at all times. The rate of mortality among the pups is very high. Numbers of them are drowned each year; they are crippled or killed outright by being trodden on by the adult members of the herds; and some starve, as when they become lost, the cows do not make any prolonged search for them, and another cow will have nothing to do with them. The greatest enemy of the adults are the killer whales (*Orca*). Several men have described to me the



FIG. 7. Part of the Piedras Blancas rookery of sea lions. Both species are present. June 5, 1927.

panic which runs through a sea lion herd on the appearance of these savage animals. An orca which was killed at the Pribilof Islands some years ago contained eight adult fur seals. Their capacity and ability to capture such fast-swimming animals as eared seals can be gauged from this. Large sharks no doubt get a few sea lions. In 1925, while I was at Monterey, California, a cow fur seal (*Callorhinus*) was brought to me for identification. It had been found on the beach north of Monterey, in a dying condition. It was still warm when I saw it. It had been bitten through the body just anterior to the hind flippers and the backbone was broken. The bite was undoubtedly that of a shark.

Sea lions seem to be fairly free from disease. During the survey three animals were observed which were blind. These were all California sea lions. A young bull was the first observed at Point Bennett, San Miguel Island, on June 10th. At Frazer Point, on June 14th, there

was a full grown bull, and at Gull Island on the same date was another, both totally blind. These animals were all in good condition, the conclusion being that the diseased condition was of recent origin. It was possible to observe these animals at close range. The disease seems to be an infection of the conjunctiva, leaving the eye covered with a bluish white film. Whether the eye itself is affected or whether the animal recovers before falling prey to some of its enemies I do not know. Animals with a handicap of this sort do not long survive in the natural environment. Whether this represents an epidemic or a usual condition will be an interesting future study.

Prof. G. F. Ferris, of Stanford University, tells me there are two species of sucking lice found on both species of sea lions.



FIG. 8. Part of the Flea Island rookery of sea lions showing both species. June 13, 1927.

Man can also be included among the enemies of the sea lions. Every year a number (just how many is not now known) are taken for exhibition and scientific purposes. These are almost always California sea lions. The Stellers are too large to be conveniently handled in anything but a large, permanent tank. The trained "seals" exhibited in circuses are practically always California sea lion cows. Since the sea lions were first known in California, the bulls have been killed for the "trimmings." This effectively eliminates most of the bulls of breeding age, and has no doubt been a large item in the decrease of the herds. This year (1927) another factor has been added to the numerous checks already acting on the sea lions. The professional hunter has come to California and, by various subterfuges, is endeavor-

ing to have the hunting of sea lions legalized.* Some of these hunters killed sea lions along the coast, during June of this year, without consulting the authorities. They later endeavored to interest the fishermen's organizations in raising a fund to pay a bounty, but nothing was accomplished in this direction.

A large number of sea lions were killed at San Miguel Island in violation of the law protecting sea lions in district 19. The methods used by these men would exterminate the sea lions in a few seasons. Bulls, cows and pups were killed indiscriminately, and only the scalps and "trimmings" removed. The carcasses were left to rot on the beaches. As sea lions shot while in the water, in most cases, sink at once, a great many animals probably went to the bottom without benefiting the hunters. The beach at Flea Island (San Miguel Island)



FIG. 9. Flea Island after a visit of the scalp hunters. Numerous dead animals litter the beach. The scalps were taken by law violators who turn them in to those states which pay a bounty on sea lions. June 16, 1927.

supported a mixed rookery of nearly 400 sea lions when I visited it on June 13th. Two days later I again landed there. In the meantime, the sea lion hunter had done his work. Every pup on the rookery was dead, and of the 400 animals which I counted on my first visit, a pitiful remnant of 30 or 40 was swimming timidly about in the surf. (Compare Figs. 6 and 7.) The beach was covered with dead animals and pools of stagnant blood.

These are not the methods for controlling our native fauna which will be conducive to the best interests of all concerned. This sort of

* In some other parts of the country, sea lions have been hunted for a number of years under a bounty system. Sea lions in these places have become so scarce that the hunters are forced to look for more prolific hunting grounds and are coming to California.

thing is comparable to the wasteful and useless slaughter of the bison, to the ruthless killing of the egrets by the Florida plume-hunters and to the extermination of the sea otter. A few men realize a quick profit for a few seasons—and one of our most interesting and least known mammals will be numbered among the animals of the earth which have passed, through the ignorance and greed of man.



FIG. 10. A dead bull California sea lion with the trimmings removed. About 700 pounds of meat, hide and oil are wasted every time a large sea lion is wantonly killed. San Miguel Island, June 16, 1927.

THE SMELTS OF THE SAN PEDRO WHOLESALE FISH MARKETS.¹

By FRANCES N. CLARK.

Although the smelt fishery of California can not be classed as a major fishery of the state, the total number of pounds landed exceeds that of the striped bass or the sable fish, and ranks eleventh among fishes sold exclusively for the fresh fish trade.

Smelts are caught along the entire coast of California and landed in varying amounts at all ports. The ports of Los Angeles County, however, exceed any other region in the total amount of smelts landed. During the past nine years, 29 per cent of the total catch of the state passed through these ports. Within Los Angeles County, practically all the smelts are delivered to the wholesale fish markets at San Pedro, consequently, nearly one-third of the smelt catch of California is handled at this one port.

¹ Contribution No. 67 from the California State Fisheries Laboratory of the Division of Fish and Game, October, 1927.

Unfortunately, the name smelt is applied to fishes of two different families comprising several genera, and the above statistics give no information about the catch of any one variety of smelt. Since the San Pedro fish markets occupy a position of major importance in the smelt fishery, the following survey was undertaken to determine what species of smelt pass through these markets, and the relative importance, throughout the year, of each form.

The families of fishes known popularly as smelts are, the true smelts, *Osmeridae*, and the silver-sides, *Atherinidae*. The true smelts are readily separated from the silver-sides by an adipose dorsal fin which does not occur in the latter family. The *Osmeridae* are taken only in the more northern waters of California and do not occur south of Monterey. The silver-sides, on the other hand, are found along the entire California coast, and consequently contribute to the northern fishery and, south of Monterey, comprise the entire smelt catch. In the waters adjacent to San Pedro, the *Atherinidae* are represented by four species, the jack smelt, *Atherinopsis californiensis*; the panzarotti, *Atherinops affinis littoralis* and *Atherinops insularum insularum*; and the grunion, *Leuresthes tenuis*. Of these three genera, the jack smelt attain the largest size and are of the greatest commercial importance; the grunion are the smallest, and the panzarotti occupy an intermediate position between the other two.

Some confusion exists in the common names applied to these fish, especially to that of *Atherinops*. *Leuresthes* is always known as grunion and the larger individuals of *Atherinopsis* are termed jack smelt. The smaller *Atherinopsis* and *Atherinops* are often confused and called variously, silver smelts, bay smelts, least smelts, and panzarotti. Panzarotti,² an Italian term, meaning broken belly, is applied by the fishermen most frequently to *Atherinops*. Since it is a distinctive name, and the one always recognized and most commonly used by the fishermen and dealers, panzarotto has been adopted in this article to designate *Atherinops*. At least two species of *Atherinops* are found in the San Pedro markets, but they are here grouped under the name panzarotti.

While the species and subspecies within the genus *Atherinops* are difficult to determine, the three genera, represented by jack smelt, grunion and panzarotti, can, with a little practice, be readily separated. The grunion is easily distinguished by its small size, slender form, and freely protractile maxillary. The teeth are minute or entirely absent, and the origin of the first dorsal is posterior to the vent. The largest jack smelt can be separated by their size, and all jack smelt are recognizable by their small scales, about 77 in the lateral line, deeper body, simple teeth, and first dorsal originating anterior to the vent. In the panzarotti the snout is blunt, the scales large, 52-56 in the lateral line, the teeth forked, and the origin of the first dorsal posterior to the vent.

To determine the relative amounts of these three forms of smelt landed at San Pedro, the survey on which this report is based, was conducted for a year. From October, 1926, to October, 1927, the

² In literary Italian, pure Tuscan, this word would be *panciarotto*, plural *panciarotti*. Since pure Tuscan is not the native tongue of any of the peoples along the Italian coast, the form *panzarotto*, plural *panzarotti*, has been adopted here. *Panzarotto* is the form used by the fishermen, and has thus come into current usage. These philological notes were kindly furnished by Dr. H. H. Vaughan of the University of California.

markets were visited three times a week. With the exception of February, March and April, when the survey was carried on by Carl R. Jackson, the observations were made by the writer. In the winter months, the visits were made between 7:30 and 8:30 a.m., as the largest percentage of the fish was landed at that time. In the summer, the fishermen returned to port later in the morning and the observations

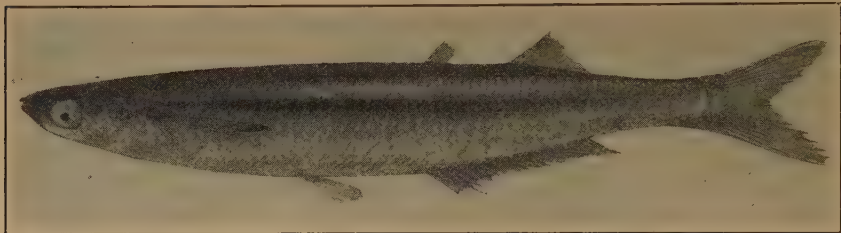


FIG. 11. Grunion, *Leuresthes tenuis*, from the San Pedro wholesale fish markets.



FIG. 12. Panzarotto, *Atherinops affinis littoralis*, from the San Pedro wholesale fish markets.



FIG. 13. Jack smelt, *Atherinopsis californiensis*, from the San Pedro wholesale fish markets.

were made from 8:30 to 9:30. In a few instances, if no smelts were seen in the morning, a second trip was made to the markets late in the afternoon, but this gave little added information.

The smelts are delivered to the markets in boxes averaging approximately 175 pounds each. Every box of smelt found in the markets during an observation was examined and recorded as containing either

jack smelt, panzarotti or grunion. If more than one form was found in a box, the fish were counted out at random until twenty of the predominating species had been counted. The box was then recorded as containing the resulting proportion of each species. For example, the record for March 2, 1927, is as follows:

1 box, all jack smelt.

1 box, proportion 9 jack smelt; 4 panzarotti; 20 grunion.

$\frac{1}{2}$ box, proportion 20 jack smelt; 0 panzarotti; 2 grunion.

$\frac{1}{3}$ box, proportion 20 jack smelt; 3 panzarotti; 0 grunion.

1 box, proportion 20 jack smelt; 0 panzarotti; 6 grunion.

From these field data the monthly and quarterly percentages of each variety were calculated.³

By multiplying the number of boxes by 175, the average weight per box, the approximate number of pounds of fish that had passed under observation was determined. To find what percentage of the total catch had been examined each month, the number of pounds seen was divided by the total monthly catch. The results, given in the last column of Table I, show a variation from 11 per cent to 54 per cent.

TABLE I.

Observed Proportions of Each Species of Smelt in the San Pedro Wholesale Fish Markets and the Percentage of the Total Catch Represented by the Observed Data.

Date	Percentage			Approximate number of pounds*	Per cent of total catch
	Jack smelt	Panzarotti	Grunion		
1926—					
October.....	99.9	0.1	-----	4,244	11
November.....	99.6	0.4	-----	13,650	42
December.....	98.9	1.1	-----	23,625	50
1927—					
January.....	95.9	1.4	2.7	17,719	48
February.....	71.4	8.3	20.3	5,206	18
March.....	94.2	2.7	3.1	6,912	17
April.....	99.4	-----	0.6	5,163	16
May.....	89.1	5.8	5.1	5,534	33
June.....	97.0	2.8	0.2	14,306	34
July.....	93.3	6.4	0.3	4,998	19
August.....	97.0	2.9	0.1	6,584	22
September.....	94.5	5.3	0.2	15,444	54
October, November, December, 1926	99.2	0.8	-----	41,519	35
January, February, March, 1927	91.2	2.9	5.9	29,837	27
April, May, June, 1927	95.7	2.9	1.4	25,003	27
July, August, September, 1927	94.9	4.9	0.3	27,026	32

*Calculated on basis of 175 pounds per box.

While more extensive observations might have been desirable in some instances, the data are considered sufficiently reliable to justify their use as a basis for determining the amount of each variety of smelt landed at San Pedro.

Tables I and II and Figure 14 show the results of the year's observation. With the exception of February and May, over 90 per cent of the smelts delivered to the San Pedro markets were jack smelt. The

³ The percentage of each form in each box was calculated from the field data. These percentages, when multiplied by the number of boxes, if more than one box contained the same percentages, summed, and divided by the total number of boxes for the day, gave the day's percentages. The percentages for each day were again multiplied by the number of boxes observed on that day, summed, and divided by the number of boxes seen in a month. This gave the monthly percentages. In the same manner, the quarterly percentages were derived from the monthly percentages.

TABLE II.

Number of Pounds, by Species, of Smelt Landed in Los Angeles County, Based on the Observed Percentage of Each Species.

Date	Jack smelt	Panzarotti	Grunion	Total*
1926—				
October.....	37,667	38	-----	37,705
November.....	32,659	131	-----	32,790
December.....	47,071	524	-----	47,595
1927—				
January.....	35,178	514	990	36,682
February.....	20,982	2,439	5,966	29,387
March.....	40,172	1,151	1,322	42,645
April.....	33,158	-----	200	33,358
May.....	14,730	959	843	16,532
June.....	41,287	1,192	85	42,564
July.....	24,958	1,712	80	26,750
August.....	28,921	865	30	29,816
September.....	26,946	1,511	57	28,514
Totals.....	383,729	11,036	9,573	404,338

*From statistics gathered by the Division of Fish and Game of California.

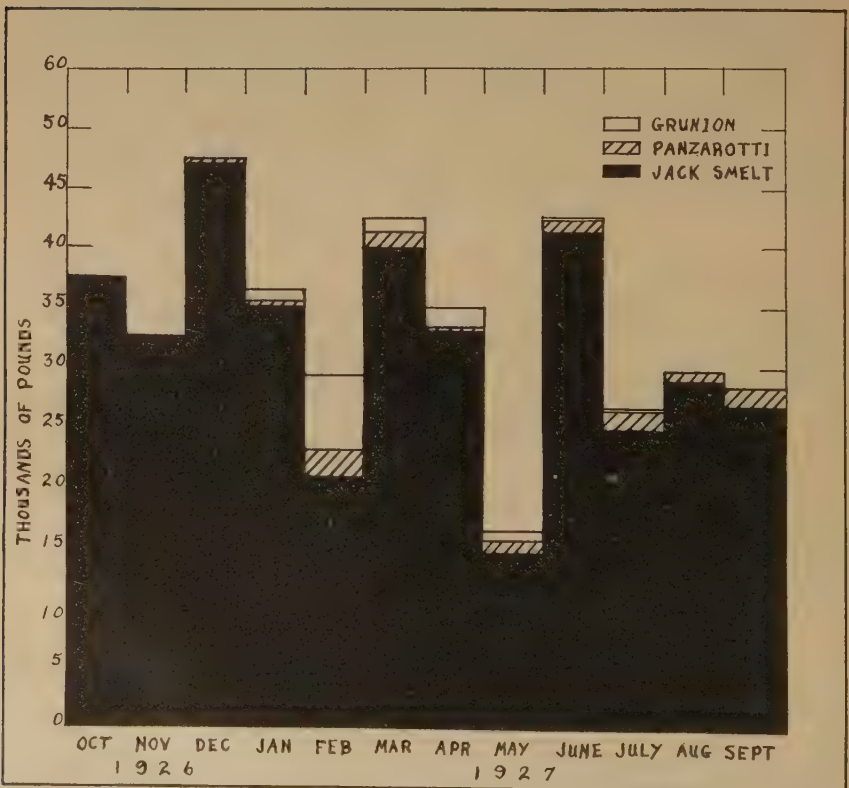


FIG. 14. Number of pounds, by species, of smelts landed in Los Angeles County, based on the observed percentage of each species.

lowest percentage of jack smelt occurred in February, when this fish comprised only 71 per cent of the whole, but since the percentage was high in January and again in March, it would seem that the drop in February was due to a chance variation, and not to a seasonal fluctuation in the fishery. Grouping the data by quarters brings the percentage of jack smelt above 90 throughout the whole year. This grouping makes the data comparable with statistics published quarterly by the Division of Fish and Game.

Panzarotti occurred in small quantities throughout the whole year, but the data suggest a slight increase in percentage during the summer months. The grunion catch was most concentrated in the late winter and spring months, and negligible during the remainder of the year. It seems probable that no great significance should be attached to the unusually high percentage of grunion taken in February.

The spawning season for the jack smelt occurs during the winter months, for the grunion, during the spring, and for the panzarotti, during the summer. Since the maximum percentage of each species corresponds roughly with the months of spawning, there may be a slight correlation between time of spawning and the amount of jack smelt, grunion or panzarotti taken by the fishermen. However, such indications are exceedingly slight, and the great preponderance of jack smelt at all times of the year entirely overshadows any significant fluctuations in the relative amounts of the three forms. If the year in which the observations were made is typical, the smelt fishery at San Pedro is composed almost exclusively of jack smelt.

HOW A NATURAL RESOURCE IS BEING ADMINISTERED.*

By W. L. SCOFIELD.

In an offhand way we will agree that research work is a good thing, even necessary perhaps, but why should any department of the Division of Fish and Game of California establish a research laboratory as an integral part of its organization? Would such a laboratory actually be of direct and practical aid to a department, and could we be justified in calling research necessary to the extent of providing it a place in a state department on a par with administration or law enforcement? The Commercial Fisheries Department in its organization places research on such a parity. It is rather unique in this respect. Other organizations express interest in research but in actual practice the scientific work is considered a side issue, and it is hoped that the results of the investigations may be of use indirectly or possibly of direct use at some time in the future. A passing interest in scientific work and a dependence upon research are two very different things. The Commercial Fisheries Department expects its

* Contribution No. 66 from the California State Fisheries Laboratory, October, 1927.

research work to be of direct and immediate practical value in addition to laying a foundation for the future development of the department. What is the laboratory doing to justify this confidence in research?

By straining a point we may say that the work of the Commercial Fisheries Department falls under three heads—Administration, Research, and Law Enforcement—but such a classification is artificial because there is no definite dividing line for any one type of work. Each is so dependent on the others and so interlocked with the other two that no one activity of the department can be singled out and called purely administration, research or law enforcement. This appears to be an exaggeration, but in practice the research workers are dependent on the patrol department and the law enforcement officers are dependent on the laboratory staff, while the administration of the department is dependent on, coordinates and directs the patrol and research. Almost every action of a member of the department involves more than one of the above functions.

The department as a whole is assigned the duty of applying conservation practice to a state resource, the commercial fishes, aquatic animals and marine life of California. This means that the state must receive the benefit to be derived from the wise use of this resource, the fullest utilization possible. Since fish constitute a resource that is capable of reproducing itself, full utilization means continuous and perpetual use rather than a brief period of over-utilization resulting in a depleted resource. A radical reduction in resource means less use or even no utilization whatever as in the case of the sturgeon in California. Halibut and salmon are examples of resources depleted to the extent that utilization is now only a small fraction of what it should be.

It is impossible to even discuss proper utilization of a resource without some knowledge of its extent. You can't make even a sensible guess at how much interest is due you at the bank if you haven't the remotest idea of what the principal is. If you are foolish you can make a wild guess at it for a year or so but sooner or later you are shocked into realizing that you are overdrawn. In withdrawing interest it is bad to guess at the principal but it is doubly foolish to keep no record of the interest drawn. Some resources, including some fisheries resources, are handled just that way, but fortunately California adopted more business-like methods and conservation practice is being applied to our commercial fisheries. It should be obvious in applying a policy of continuous use to a resource such as fish that what we need most is to know something of the total supply and of the amount caught each year. Chiefly we wish to know whether the yearly catch is more than it should be or less than it could be with safety for the future. Other considerations are secondary. In the case of ocean fish, the answers to these questions are exceedingly difficult to arrive at, but the difficulty of solution does not lessen their importance nor is sensible administration of the resource any less dependent on fundamental knowledge as to extent of the supply and the rate at which it is being utilized. We need not crow about recognizing the obvious, but California deserves great credit for doing something after the obvious needs were recognized. The Commercial Fisheries Department set itself the task of answering the most important questions first instead of postponing them in favor of less important but more spectacular work. Proper

administration of the resource should not be based on guess work, so it was decided that knowledge of the resource should be substituted for assumptions and should serve as the foundation of the department.

Research workers were called upon to aid the department in learning something of the fundamentals of the fish supply to be administered and the State Fisheries Laboratory was established. The staff was asked to make accurate observations as to the resource, check these observations to be sure they were dependable, make an orderly arrangement of the observed facts, and as a final step to draw conclusions based on facts rather than on assumptions. That procedure is the essence of the scientific method. It might be called systematized common sense. When the Ford is missing you go over it and trace the



FIG. 15. California State Fisheries Laboratory, Terminal Island, California. October, 1927. Photograph by G. H. Stone.

trouble down to a blackened spark plug rather than oil the timer on suspicion, and to that extent you apply the scientific method without wearing your hair long or using a microscope.

The program of the laboratory then is clear cut and definite; to aid the department in getting the necessary information as to fish supply, to estimate how heavily the supply of each species may be drawn upon, to discover any changes occurring in the supply, and to determine at what point depletion begins to show itself. This is a large program but it is the proper one. The complete fulfillment of such a program will require many years of the concentrated effort of the best brains that can be applied to these questions, but complete fulfillment is not

immediately necessary. In the meantime every fact learned supplants a guess. Each year the administration of the resource is increasingly effective as more facts are available and assumptions are discarded.

Before any such program could be put into effect, it was necessary to survey the whole field for possible methods that might be applied and to determine what line of approach promised to lead toward the goal set. In this field of research the methods and details of procedure have not been worked out, so that we of necessity are having to determine the value of methods by trying them out and this adds to the difficulties and delays. We are suffering all the hardships and experiencing all the thrills of discovery that go with pioneering.

One of the first and one of the most important steps taken by the department in learning about the fish supply was to establish a complete and accurate system of statistical records that would show the daily catch of each species of fish for each boat for each fishing region of the state. It is hard to run any large business with no system of bookkeeping, and these total catch records are of great value in understanding what is happening in each fishery, in determining questions of relative importance, in determining seasons, and in tracing the effects of legislation. Important as these questions are, they are secondary when compared to the real object of establishing this system of catch records, that is, determining changes that may occur from year to year in the supply of fish. The system was designed so that we might have the daily catch of each boat. The catch of one boat for a day may be accepted as a measure of the return in fish for a definite unit of fishing effort. It is a measure of the availability of fish. From these records a group of certain boats may be selected and their daily catches followed through a series of years in order to determine whether the trend of their success is declining, remaining constant or possibly showing an increase. Other things than the supply of fish affect the boat catch so that allowing for and discounting them is not a simple operation. This analysis of the catches of individual boats is one of the two chief methods we have selected as promising to give us knowledge of changes in the supply of fish.

Another method is to sample the commercial catch at regular intervals to determine the normal proportion of age classes appearing in the catch and to watch for any future change in this proportion. This is based on the theory that depletion, if it occurs, will show itself in a drop in the proportion of older fish. We all know of the irritating scarcity of big trout in an over-fished stream as compared with a virgin stream. Such a method involves adequate sampling of the commercial catch and this means many laborious hours examining and measuring specimens from the catch. Although this is a long and slow process extending over a series of years, we expect it finally to yield results that are more complete and give us greater knowledge of the supply than are possible by a boat catch analysis alone.

The program as outlined so far is given first consideration, but it is only part of the story. Suppose we find that a certain species is being depleted, then we should know what we are going to do about it. Why guess at the remedy? We need to know how a certain remedy is going to affect this particular species. The effect of any one protective law is apt to depend on some peculiarity in the life history of this

particular fish. At the same time that we are working on questions of fish supply it is necessary to carry on work aimed at giving us the necessary knowledge of the life history and behavior of each species that we are considering. It is by no means possible to tell beforehand just what piece of information as to life history is going to prove necessary. The more we know of the habits and behavior of a species the more confidently we may venture to predict how it will be affected by a protective measure that might be applied.

The research work of the Commercial Fisheries Department is not a desirable or even necessary side issue. It is the basis upon which the department is organized, and it is so interwoven with the work of the department that it would be difficult to clearly define its boundaries and impossible to segregate the purely investigative work from the other activities of the department. It is obvious then that such work must be conducted by the state department rather than depend on by-product fisheries investigations from some other organization such as a university or independent marine station. The very nature of the work involves state legislation and department regulation. In administering our fisheries, the department is endeavoring to determine the point of full utilization for each fishery, and to discover over-utilization before it becomes serious depletion of the supply. It would be easier and cheaper to guess at this, but the department is basing its work on dependable information rather than surmise. The research laboratory is assisting the department in determining the facts.

SALMON INVESTIGATION.

By J. O. SNYDER, Stanford University.

Believing that measures intended to conserve a fishery can not be intelligently devised and applied until the life history of the species is well known, an investigation of California salmon was begun some years ago, and is still in progress.

Along with other work of a statistical nature the Division of Fish and Game has been keeping a very accurate account of all salmon taken by the commercial fishermen wherever they have been operating. An examination of this reveals an alarming decline in the fishery, and points to the need of even more restrictive measures than have as yet been applied.

Observations of the catch have been made at many places, both along the coast and in the rivers. These include the close scrutiny of thousands of individuals in an effort to determine sex, age, and certain phases of ocean and stream history. A microscopic examination of the scales reveals certain pertinent features of the life history of the fish, and the results of many of these are now available. Active field work has resulted in the collection of a vast amount of material such as scales, young fish, anatomical parts, field notes, photographs, drawings, etc., which are now stored in the Division's laboratory. It is expected that papers bearing on the investigation of this material will appear in due time.

Some observations of an interesting and valuable nature have been made on young fish caught at sea and in the main channels of the rivers.

During the seasons of 1927 and 1928 an effort was made to place metal tags with distinctive marks on fish which were caught at sea. It was thought that the recapture of the released fish would contribute something worth while to what we know of ocean migration. Difficulties encountered were so great as to put a very definite limit on the undertaking, and the results to date are not very encouraging.

Much work of an experimental nature has been carried on in an attempt to answer questions or solve problems relating to the life history of the king salmon. One of these experiments, for example, was so planned as to make a test of the parent stream theory, and also to determine as far as possible the extent of ocean migration. It is hardly necessary to say that the parent stream theory has a direct bearing on artificial propagation, while the extent of ocean migration obviously has to do with the problem of regulating the marine fishery.

The parent stream theory involves the presumption that on maturity, salmon return to the stream from which they previously migrated to the ocean. Much evidence which favored the theory had accumulated in the past, but sufficient experimental tests were lacking. The fact that adult king salmon would return to the stream into which they had been introduced when young, regardless of where the eggs which produced them had been taken, was not fully established, nor was it known whether mature fish on their upstream migration would seek out and enter the particular tributary in the waters of which they had been reared.

A description of one or more field experiments, and a summary of the results may be of interest. The preliminaries of an experiment were described in CALIFORNIA FISH AND GAME for July, 1920, and the results were published in the same magazine at later dates. In brief, the work was performed as follows: A large number of king salmon eggs, taken in Mill Creek, a tributary of the Sacramento River, were transferred to Fall Creek Hatchery which is located on a branch of Klamath River. The fry which came from these eggs were placed in rearing ponds near the hatchery and there held until they were of sufficient size for marking purposes. The marking of young fish is a process of fin mutilation, the reliability of which has been amply demonstrated. In this particular case the adipose and right ventral fins were removed from 25,000 small fish. When the slight wounds were completely healed, the fish were allowed to pass into Klamath River. They entered the main stream at a point north of Mount Shasta, from where they passed down the river and eventually entered the sea.

Fishes from this planting were later captured in the ocean at points as far south as Monterey Bay, thus proving beyond doubt that salmon while at sea range very far from the mouths of their native streams. It is scarcely necessary to point out with this information in mind, that any procedure relating to the protection or conservation of Klamath salmon will involve a regulation of fishing at sea as well as in the river. It is not known to what extent Klamath salmon migrate to the northward, but since marked Sacramento salmon have been observed as far north as Fort Bragg, one may perhaps be allowed to infer that Klamath fish also migrate northward in search of food. None of these fish was taken in any stream other than the Klamath, where they returned in numbers, a fact indicating that salmon will

return upon their nuptial migration to the stream in which they passed their early life, rather than to that of their real parentage. It also appeared that these pond-reared fish behaved much as did those which had lived in the stream under natural conditions, that they eventually reached a similar size at a given age, and that in other respects they were like fish bred under natural conditions. A counter experiment performed in the Sacramento River produced similar results, thus confirming that of the Klamath.

It having been demonstrated that salmon, when mature, enter the streams from which they at first migrated, the Division attempted to determine just how far this homing instinct would obtain with regard to particular tributaries of a river system. Since king salmon

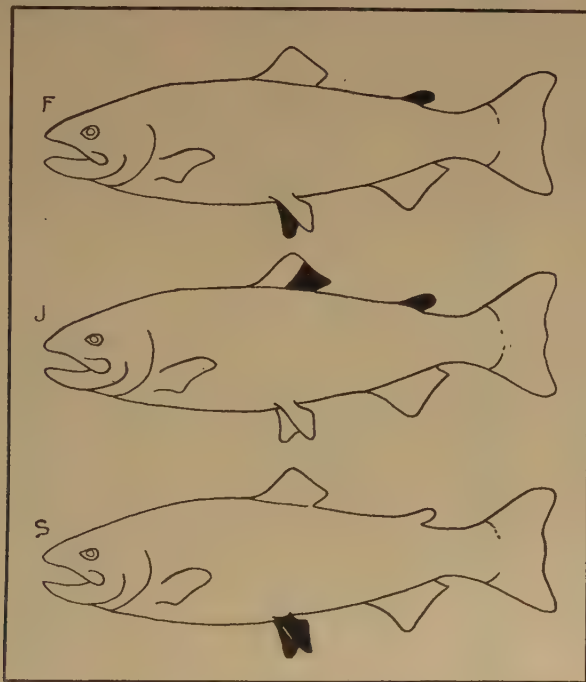


FIG. 16. Diagram showing how various lots of salmon were marked in experiments on the Klamath River.

in the Klamath mature at from three to six years of age, it will be appreciated that any experiment having to do with them must extend over a considerable period of time. Cooperation among observers, officials, packers, anglers and commercial fishermen enters largely into the work, and lack of interest on the part of someone may cause partial or entire failure.

A test of the homing instinct with regard to tributaries of a river was initiated in the fall of 1923 in the Klamath. The preliminaries of this experiment were fully described in CALIFORNIA FISH AND GAME for January, 1924. The returns are not complete at this writing, but enough observations have been made to establish certain facts.

As in the previously described experiment, the work centered about Fall Creek Hatchery, which is located about one mile above the junction



FIG. 17. Map showing location of salmon spawning and marking experiments on the Klamath River.

of the creek and the main channel of Klamath River. Fish to the number of 75,000 were marked as shown in the accompanying diagram. Each 25,000 of these was given a distinctive mark. These were carefully kept in three separate groups, each of which was eventually introduced into a separate tributary. One group, that with the right ventral and adipose removed, was allowed to leave the breeding pond and pass down Fall Creek. Another lot, minus the adipose and anterior half of the dorsal, was put into Jenny Creek at a point a few hundred feet above its mouth. The latter stream enters the main channel somewhat over two miles below the mouth of Fall Creek, and a long distance above the racks. The third planting, the fish of which were distinguished by the absence of both ventrals, was made in Shasta River about a mile above the mouth. On the following year an exactly similar planting was made. The racks near Hornbrook act as a trap, which enables one to catch and examine all fish which attempt to pass that place. Traps in Fall Creek and Jenny Creek made possible the capture of fish entering those streams.

Numerous adult fish with each of these marks have already been caught at sea and also in Klamath River, thus demonstrating the success of the plantings. Fish bearing the Jenny Creek and Fall Creek marks came to the racks in numbers, while the Shasta River mark was represented there by but two individuals. Several of the latter were caught in Shasta River by spearmen. Some of those with the Fall and Jenny Creek marks were allowed to pass beyond the racks and on up stream, where they were later recaptured. The results of this experiment, although it is not yet complete, seem to indicate that none of these fish entered any river other than the Klamath, that those bearing the Fall Creek mark returned to that stream when given an opportunity, and that the brief exposures given to fish in the other tributaries, while causing the return of some of the fish, was not sufficient to operate in all cases.

Along with the examination of king salmon, considerable information relating to silver salmon, steelheads and stream trout has come to hand. Enough material relating to the rainbow trout of the Klamath has been collected to give us a fair picture of the more salient features of the life history of this fish.

STRIPED BASS STUDIES.

By E. C. SCOFIELD.

The striped bass is one of the few combined sport and commercial fishes that we have in California. About 800,000 pounds are caught annually by the commercial nets and marketed to the people of California only. There is also a large amount caught by the sportsmen anglers for which no figures are available. However, the combined commercial and sport catch is certainly well over a million and a quarter pounds annually. Such a large catch appears startling, in view of the fact that the striped bass have had only 48 years of existence on our California coast. They were introduced from the east coast in 1879 and 1881, when two shipments were made, a total shipment of about 450 small bass. Ten years had not elapsed before they were being caught

for market purposes. The Division of Fish and Game was swift to act in obtaining legislation to limit the size and number of striped bass caught. They wished the new species to be protected sufficiently to survive the nets and hooks and increase its numbers annually.

Today we are confronted by the same question: How are we going to keep the striped bass on the increase in face of the hundreds of nets and thousands of anglers that appear as a barrier across the road to conservation? The popularity of the species demands that it be saved from a possible extermination by overfishing. The Division of Fish and Game, as a state institution maintained to regulate such matters, has taken steps to prevent such an occurrence to this valuable fish. The Commercial Fisheries Department, in whose hands lies the destiny of our commercial fishes, has launched a systematic, scientific study of the striped bass, knowing that the results obtained will form a basis for legislation and their future conservation.



FIG. 18. Catch of striped bass from Salinas River by party of three men. Photograph by G. A. Clark, 1921.

One of the most important activities of the department is to measure the abundance of the commercial fish species by means of data which have been gathered of the commercial catch. These data, provided by commercial fish dealers, are required by state law and are detailed and accurate. They have been gathered now for a period of seven years. From these data, it is possible to determine the average yearly catch of any species for a given unit of effort. Such a measurement has been made of the striped bass, and the result shows that these fish have been increasing in abundance during the past seven years.

Problem. Next to measuring the abundance of a fish, or any animal for that matter, the most important information to be obtained for proper legislation is the knowledge of the life history of the species. Such a study of the bass will show us how old they are at various lengths, how fast they grow, how old they are when they begin spawning, where they migrate, what they eat, and many other facts entering

into their life cycle. It is, therefore, the intent of this article to show how the work of obtaining the life history is carried on.

A life history study will include such studies as the spawning, development of the egg, hatching, growth, migrations, food, habits and so forth. We realize that it would be next to impossible to follow a group of bass throughout their entire life cycle in order to obtain the above facts. It is necessary, therefore, that we study only one question at a time.

Age. The first question is the determination of the age of the striped bass. It is imperative that we speak of the bass in ages rather than in sizes, for it is more accurate. Nature has provided a simple means of

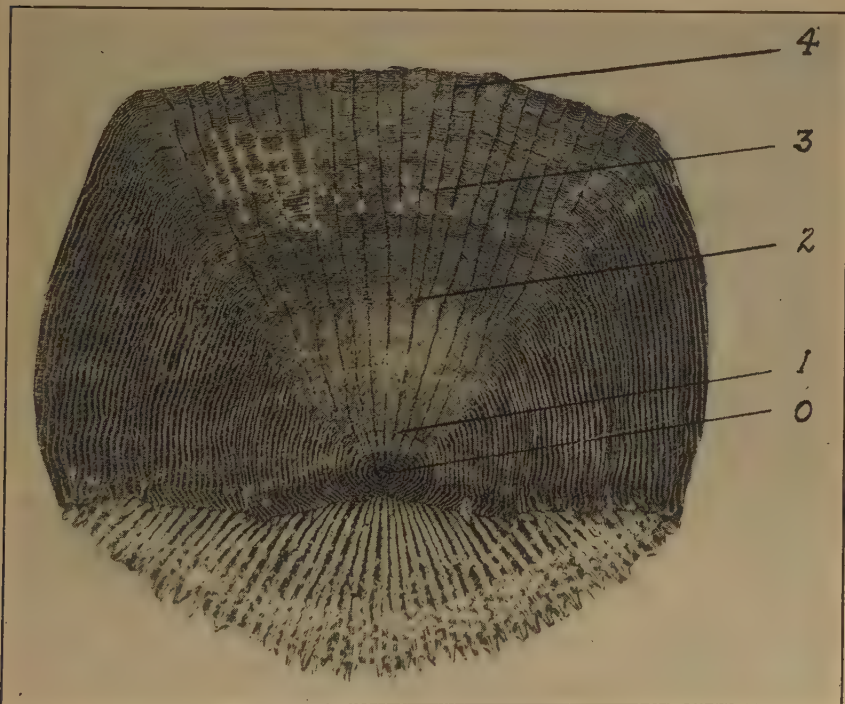


FIG. 19. Microscopic photograph of a striped bass scale. The particular bass from which this scale was taken had just passed its fourth winter; therefore, it was in its fifth year. 0 indicates the center of the scale, 1, the first winter annulus or check, 2, the second winter check, etc. Photograph by E. C. Scofield. 47 centimeters. June 1, 1927.

obtaining the age of most fishes, and that is by the markings that form on almost all hardened parts of a fish. On the striped bass, we have used the scale for age determination. A microscopic image of a scale shows a great number of rings, somewhat similar to a cross-section of a tree stump. (See Fig. 19.) For every ring in a tree stump, a year's growth is represented. A scale, however, will have from twenty to thirty rings per year, but during the winter months the bass go through a dormant stage when these rings are formed very close together. About April or May, normal growth commences again and the rings are formed much wider apart. Where the crowded rings

on the scale meet the widened rings, there is a decided mark, or check, as we call it. Because this check is formed once a year, we call it the "annual check," and the age of the bass can thus be determined.

We also find this annual check formed on other hardened parts of the body of a bass. The opercle, or cheek bone, shows the markings very distinctly when it is boiled and cleaned of its scaly surface. The markings are not so plain as those on a scale, but one can see them without the aid of a microscope by simply holding them up to the light. Another part of the body that is frequently used for age reading is the otolith, a small cradle-shaped bone that occurs in the inner ear of most fishes. To obtain best results with these, they must be examined immediately after they are removed from the fresh fish. After they are removed, they are ground down on a stone until they are so thin that a light will penetrate them. A microscopic image of the otolith at this stage will show the annual checks, as does the cheek bone. Many investigators prefer this ear bone for age determination, holding that it is less influenced by natural or artificial disorders that may affect the scales or other parts of the outer regions. The work of removing them and grinding them down is very tedious; so in the case of the present investigation, they have only been removed at random, to be aged and used as a check on the scale method of age determination.

Rate of Growth. An important obstacle in the study of the life history of the striped bass has been overcome by the determination of their age. Next, we are confronted by the problem of solving their rate of growth. It is important to learn how much a bass grows in each year of its life. The simplest method of determining this is the periodical sampling of the bass and the application of the frequency curve. Although this may seem difficult to understand, it is very simple when explained. We will assume that the bass spawn in the spring of each year. The bass that hatch from each of these yearly spawnings should grow at about the same rate. Some individuals may grow more slowly and others more rapidly. Now, if two hundred or so bass are measured, which is a good representative sample of a spawning that occurred two years ago, we obtain something like the following table:

0 bass at	7 inches
5 bass at	8 inches
20 bass at	9 inches
45 bass at	10 inches
75 bass at	11 inches
40 bass at	12 inches
10 bass at	13 inches
5 bass at	14 inches
0 bass at	15 inches

If this table is plotted in a curve with the base measured off in inches and the height in number of fishes as in figure 20 the result is what we call a frequency curve.

Now, if we measured all the bass that have hatched since the spawning that took place, say four years ago, we would have four groups, representing bass from one to four years of age. If these data were plotted in a simple frequency curve, we would see, as a result, four distinct humps, one for each year or age group, as is seen in Figure 21. Of course, it is impossible to catch and measure all the bass which have been spawned, even for one year, but it is possible to obtain a liberal sample of the fish which is representative of the bass population in San Francisco Bay. However, it has not proved easy to obtain this representative sample, for commercial fishermen are not allowed to use a net with smaller mesh than $5\frac{1}{2}$ inches, and they catch very few bass under five years of age. It is necessary, therefore, to use a large seine with small mesh, and to do this an experienced seine fisherman must be hired. It is also required that a special permit be obtained to take the bass for scientific purposes.

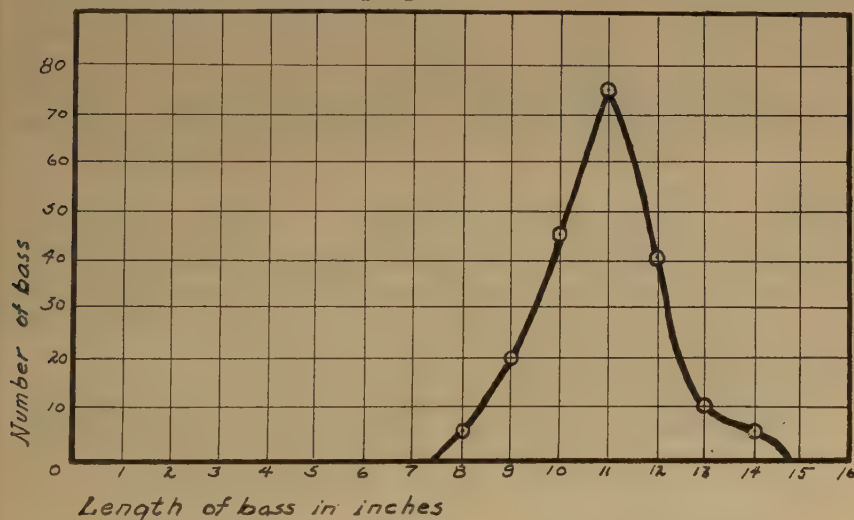


Fig. 20. A typical length-frequency curve of the two-year group of striped bass. The points on the curve represent the number of bass at a certain length. The first point to the left shows that there are five bass of eight inches in length, and the second point shows that there are twenty bass of nine inches in length, etc. The mode, or highest point, indicates that the majority of the two-year old bass are eleven inches in length.

If the sampling of the bass population, as described in the preceding paragraph, is done periodically, say every month, we would expect to gather larger bass each time, as a result of growth. This proves to be true, for when the material is measured and plotted in frequency curves, we observe a movement of the various humps to the right, showing an increase in size as time progresses. This is well illustrated in Figure 21. In this manner we can obtain a very accurate record of the growth of striped bass throughout the first few years of their life, at least.

Another important use of the frequency curve is the checking of the age reading from scales. The frequency curve shows us that a bass is from eight to fourteen inches in length at the end of its second year. The scale reading method, therefore, should show that a two-year old

bass is from eight to fourteen inches in length. Any results to the contrary would expose an error, either in the scale reading or in the formation of the frequency curve.

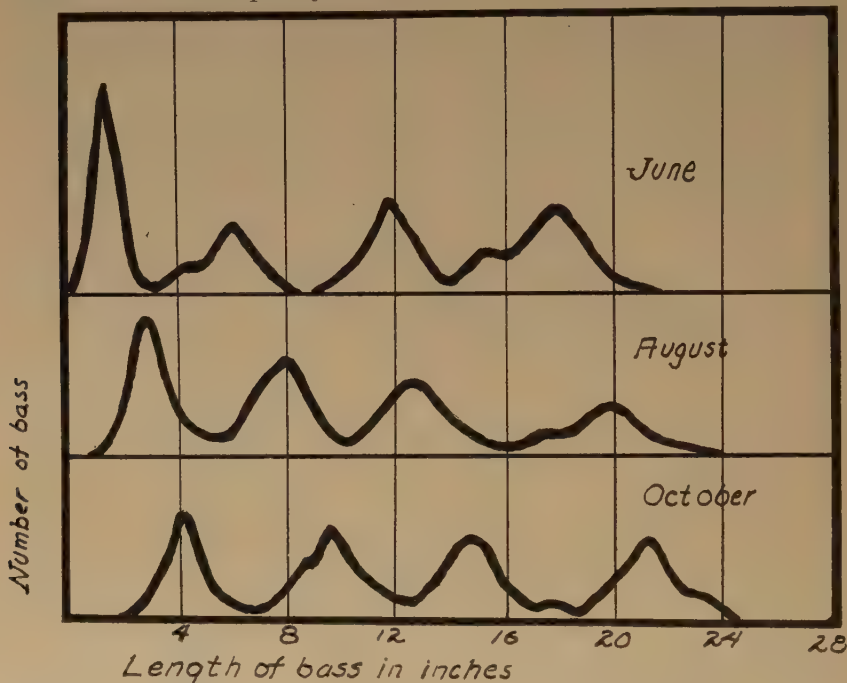


FIG. 21. Ideal length-frequency curve of four age groups of striped bass, showing their respective advances in growth over a period of four months. Each peak of the various humps, or age groups, for August and October shows a decided advance to the right as compared with June. This illustrates growth, and is the method employed to determine the rate of growth of striped bass.

A series of lengths which were computed from a group of bass scales has given us a rough, yet interesting, chart of the average lengths of bass at various ages. The results are in the following table:

1 year old bass average	4 inches
2 year old bass average	10 inches
3 year old bass average	15 inches
4 year old bass average	18 inches
5 year old bass average	20 inches
6 year old bass average	23 inches
7 year old bass average	28 inches
8 year old bass average	32 inches
9 year old bass average	36 inches
10 year old bass average	39 inches
11 year old bass average	41 inches
12 year old bass average	42 inches

Age of Maturity. The age and rate of growth having been solved, we next turn to the question of the age at which the striped bass mature and spawn. This question is one of the primary studies of

this investigation. The results will show the percentage of spawning bass that are, and those that are not, protected by the present sized fishing gear or nets. For example, we will say that the bulk of the commercial catch is made up of bass that are in their fifth and sixth years. If it is discovered that the majority of the bass spawn for the first time in their fourth year, then that spawning group is protected from the nets and should spawn unmolested. Such a condition in any fishery should result in the maintenance of the present abundance of that species. The method being followed is to test the bass ovaries for their degree of maturity or immaturity prior to and during the spawning season. A thousand or so specimens from two to ten years of age are examined in this manner. A hundred or so individuals representing each age should show the percentage of bass that spawn for the first time in their respective ages. The difficulty encountered in this method was the inability to get the desired material. We were obliged to gather our own material by using a seine, as previously stated, and our results were unsatisfactory. Because of this difficulty, we have resorted to the commercial catch entirely for our material, in spite of its selectiveness. It is believed that we can obtain good results in this manner, for once the age of maturity of the commercial group is obtained, it will be comparatively simple to determine the younger ages of maturity.

Migrations. We have determined the age of the striped bass, as well as their rate of growth. We are now working on the problem of age of maturity. Only two important features of this investigation, then, remain untouched. These are the migrations and the food of the bass. The migrations are a problem that can be partially solved through close observation and individual information. However, the more accurate way would be to carry on an extensive marking experiment within San Francisco Bay. The small striped bass can be obtained by the thousands in the summer time. If these were caught and marked by removing one or more fins and then liberated, they would later be caught by anglers or net fishermen and reported to deputies of the Division of Fish and Game. If the return of these marked bass was large enough, we could obtain a fairly good conception of their migrations, for we could undoubtedly get cooperation from the net fishermen within the bay, the anglers on the flats and on the sloughs, and from casters along the beaches from Monterey to Point Reyes. Information of this sort would tell something of the migration of the bass in the ocean and within the bay. This plan has not been included in the present investigation, but will probably be carried on as a separate work later. Information, however, can always be readily secured from fishermen as to movements of the bass within the bay and along the coast. We have learned from them, and from our own experience, that during the warm summer months, and perhaps early fall, the bass will school close to the shores, following the rise and fall of the tide. Their favorite grounds during these months are the mud flats where the temperature ranges from 60 to 70 degrees Fahrenheit.

The most exciting incident that we ever witnessed in regard to the bass schooling on the flats occurred early in July of this year. Our collecting boat had been scouting the bay for two days, without a sign

of bass. Weather conditions for their capture had been poor, but on that afternoon the wind had changed to the northeast, and the northern shore of San Francisco Bay was very calm. It was fine weather for the bass to be schooling on the flats, so we headed our boat for Black Point. The sunset marked our arrival. The surface of the water was as smooth as glass, for there was not a breath of wind. As our boat glided through the shining water, we suddenly became aware of a few jumping bass in the shallow water beyond. In a moment we were surrounded by splashing bass. The captain of our collecting boat had witnessed such scenes before; so for our benefit, he took a long boat hook and hit the water a resounding smack with it. The result was as if some unseen hand had hurled a ton of rock over the surface of the water in all directions. Striped bass from one-half to six pounds in weight splashed and squirmed in the shallow water, in their frantic efforts to escape danger. The water was a boiling mass of fish. In a few minutes they had subsided and the surface gradually became smooth and finally resumed its silvery tint. The captain estimated that at least twenty tons of striped bass were in that one school.

We see nothing of this sort when the cold weather sets in. The bass leave the flats and seek the depths of the channels and sloughs. At times they rise to the surface, but never do they in schools approach the flats which formerly had been their habitat. In the channels of the bay the movements of the bass occur at lower depths. Surface nets are discarded and submerged nets are employed almost entirely. A net of this sort is a typical gill net, except that it is heavily leaded so that when placed vertical in the water it will sink below the surface. Buoys, however, with twelve-foot ropes tied to them and to the top of the net allow the net to sink only twelve feet below the surface. By this method a fisherman can use a regular drift gill net at lower depths where the bass are. Should the law allow, the fishermen would fish the bottom of the channels, for there they claim the bass can be found in larger quantities in the winter months.

The sloughs afford a great habitat for wintering bass, especially the larger ones. Occasionally a big one is landed by a skilful angler but the bulk of the bass refuse the baited hook at this time of the year. The bass are there, however, because we have made successful experimental catches during the coldest months, namely December and January.

The ocean fishermen have also given valuable information in regard to ocean migration of striped bass. They have told us that during the winter and early spring months, the fishing is very poor. About the last of July the bass are caught in large numbers. This run lasts until early fall, about October, at which time the biting practically ceases. These facts seemingly indicate a seaward migration immediately after their spawning, which occurs in the spring months. From October to March their diet lightens considerably. They appear to seek the deep water and the rivers that enter the ocean, where they lie practically dormant save for intervals when they take nourishment. Spring sees them stirring around for food and, as a result, a few are taken on hook and line off the beaches and in the rivers. We must take into consideration, also, that the amount of bass caught by anglers off the beaches and in the rivers does not necessarily form an accurate basis on which

to determine their migrations. If linked with accurate methods of migration study, such material would be valuable; but if used alone, it would be valueless as far as accurate scientific research is concerned.

Food. Closely related to the migrations is the food of the bass. We have found that the migrations or movement of the bass within the bay and along the coast are largely dependent upon the food they are seeking. During the warm summer months the bass school on the mud flats. There, also, is the small feed of these ravenous eaters. In the fall, when cold weather sets in, they leave the flats, and with them go the smaller fishes. We have seen occurrences similar to this in the ocean. We have watched the Salinas River all through the ebb tide, without seeing a sign of bass. At the first of the flood tide, however, they school into the river's mouth, seeking their favorite food—the Portuguese man-of-war, which drift in with the tide.

Because the food of the bass is so closely related, in many ways, to their migrations, we have undertaken a detailed study of this question. By systematically examining stomach contents of bass at random throughout the year, we have been able to determine their food in the various localities and seasons. A wide variety of foods has been found in their stomachs. Crabs and shrimps are their main diet, but we have found that they eat almost anything they can get into their mouth lengthwise. Any food that is plentiful, such as crab and shrimp, appears to be their favorite. Small smelt occur in great numbers in the summer months and they are ravenously eaten by the bass. We once extracted a thirteen-inch splittail from a nineteen-inch bass. Exceptionally large crabs, smelt and bullheads are not uncommon in their stomachs. They eat their own young in great quantities. Other varieties of food removed from their stomachs are softshell crabs, clams, periwinkles, piling worms, herring, gobies, minnows, sticklebacks, sand fleas and grass. Bass will follow a school of fish for miles if the water is clear. Where there are sea gulls and pelicans flying over the water, one is sure to find a school of small fish, and there also will always be a school of feeding bass.

Final Report. As soon as this work is completed, a final report will be issued. It will be detailed and accompanied by charts and tables. The studies of this report on the life history of the striped bass will consist of age, rate of growth, age of maturity and facts relating to migrations.

CATCH FIGURES AND FISH SUPPLY.*

By JOE A. CRAIG.

The necessary and fundamental information which a person must have in order to intelligently manage a business of any sort, is a knowledge of the amount of capital that the business possesses and the income derived from the investment. Certainly a competent executive would not pay out as dividends part of the capital needed to maintain a business. Nor would the manager of a cattle ranch sell a great many more cattle than the natural increase of his herds, and so cut down his breeding stock to a dangerously low level.

* Contribution No. 68 from the California State Fisheries Laboratory, November, 1927.

The Department of Commercial Fisheries of the Division of Fish and Game is in much the same position as an executive employed for the purpose of managing an investment belonging to other people; the capital invested being represented by the population of crustaceans, mollusks and fishes of commercial importance, belonging to the people of the state, and the dividends derived from that investment being the catches taken from this population. The department, at a very early date in its organization, realized the importance of having accurate information concerning the size of catch of the various species of fish and the question of whether or not the amount taken was depleting the supply or breeding stock to such an extent that future profitable returns were endangered. Therefore, we find it provided by a state law, enacted in 1919, that "It shall be the duty of the Fish and Game Commission to gather data of the commercial fisheries and to prepare the data so as to show the real abundance of the most important commercial fishes." There are also provisions made for the biological investigation of depletion, but we shall mention only that portion of the study of abundance of commercial fishes concerned with the collection and use of statistical data.

It is also legally provided that all fish dealers, cannerymen or other persons buying fish direct from fishermen must fill out a triplicate form, furnished by the Division of Fish and Game, showing what species and amounts were bought, date of purchase, name, number and owner of boat that caught the fish, and price paid for the fish. One copy of this record is kept by the buyer, one is given to the fisherman selling the fish and the third copy is sent to the Department of Commercial Fisheries. In this way that department procures a complete record of every catch of fish sold in the state.

It is a simple matter to add up these records of individual catches and secure a total yearly catch for each species. The relative size of total yearly catch of a species is supposed by many to be a satisfactory method of judging the abundance of a fish over a period of years. In fact, it is a very unreliable and usually misleading basis for detecting depletion.

This is so because there are a great many factors, other than the abundance of a fish, that determine the size of the total yearly catch. As an example, a species of fish may be seriously depleted, but be very much in demand so that the price rises and consequently more men go into that fishery, with the result that the total catch stays at a high level or actually increases, because more effort is being expended on the fishery, while the abundance of the species is rapidly decreasing. Improvements in gear or fishing methods may also cause an increase in total catch while depletion is taking place. Of course after depletion has proceeded to a great extent, the total catch will fall off in spite of greatly increased fishing effort, but then it is often too late to recoup the losses and get the fishery back on a paying basis.

Also the total catch may decrease while the abundance of the species is constant or even increasing. This may be due to a falling off in demand for a certain fish, or an increased demand for another species, causing less effort to be expended in the taking of the species in question. A strike of a fishermen's union or storms may also cut down the number of fishing days available to the fishermen and cause a decrease

in their fishing effort and total catch, while the abundance remains unchanged or increases. A closed season or legislation prohibiting the use of some particularly effective gear may decrease the total catch, while these protective measures are really causing an increase in abundance.

Evidently then, the catch data must be carefully analyzed and changes in fishing effort, gear and available fishing days discounted by some means before authentic information concerning the relative abundance of a species of fish can be obtained. A boat catch analysis is a procedure which, as far as is possible, accomplishes this, and in brief gives us the return for a constant unit of fishing effort and gear over a period of years.*

In a general way the method of making a boat catch analysis is as follows: As has been explained, the Department of Commercial Fisheries receives tickets which are complete records of every catch of fish sold in the state. These tickets are sorted and filed by boat at the State Fisheries Laboratory. This means that we have a record of each catch of every commercial fishing boat filed in chronological order. Also, each boat owner is required by law to register his boat each year, giving gear used, sort of fish caught during the previous year, number in the crew and a complete description of the boat.

When it is decided to conduct a boat catch analysis of a certain fishery, the first step is to go through the tickets and select a number of boats operating continuously in that fishery during the years to be included in the investigation. The registration cards of these boats are then gone through and checked over to see if there has been any marked change in gear or personnel which would change the efficiency of any of the boats. The catches of any boats having changes in gear or marked changes in crew number should be discarded since they do not represent the product of a constant unit of gear. A large enough number of boats should be secured to insure a good sample of the catches of the fishery being investigated. The catches of the boats selected are then tabulated by days, that is, each daily landing or catch is recorded with date upon which it was sold. This is done for each boat separately. This process of selection of boats and tabulation of catches gives us a day-to-day record of the output of a constant unit of gear and fishing personnel employed over the period of time to be included in the analysis.

The records of all of the boats selected can then be combined and the average daily catch computed for each year, or shorter period of time if desired. There are several different sorts of averages that can be used for this purpose, and a careful analysis of the data and fishery is necessary to decide upon the best form of average to use and how it should be computed. This then gives us the relative result of a constant unit of fishing effort and gear used for a constant unit of time. In other words, the final result is the daily average catch of a fixed unit of fishing effort and gear computed in yearly periods or shorter units of time over an interval of several years.

* The first work undertaken in North America on catch returns per unit of gear, as far as we know, was done by Mr. W. F. Thompson on the halibut of British Columbia, and published by the British Columbia Fisheries Department in 1915. Mr. Thompson also made a boat catch study of the albacore fishery during the time he was Director of the California State Fisheries Laboratory.

These results when considered as yearly averages would be indicative of the yearly fluctuations in abundance, or at least the availability to the fishermen of the species studied, if no changes in economic, weather or biological conditions had taken place during the time included in the boat catch study. However, some change, such as adverse weather for the best catches, or a great demand for another fish, taken perhaps with the same gear as the one studied, may have caused the fishermen to make only small incidental catches of the one in question, and fluctuations would result in the average boat catch so that it is not an absolutely accurate measure of the abundance or availability of the fish to the fishermen. Also the appearance of the offspring of an unusually successful spawning season in the commercial catch may cause a temporary increase in abundance, which would not be especially significant if the study of abundance extended over a long period of time.

Therefore, when the average daily catch per year has been computed, the problem of a person undertaking a boat catch analysis is by no means completed. All available data on economic, weather and

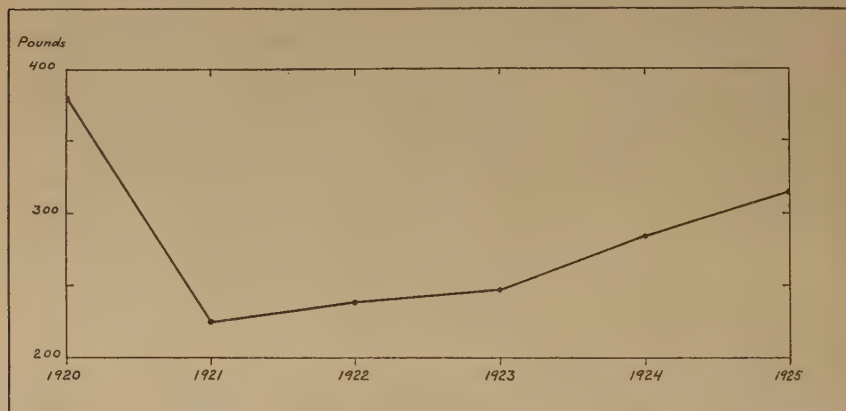


FIG. 22. Graph showing the average daily boat catch of shad of twenty boats fishing in the San Francisco bay district for the years 1920-1925, inclusive.

biological conditions that may affect the fishery should be carefully analyzed and applied to the boat catch analysis results, before the final result is said to be indicative of the state of abundance or availability of the fish in question. When there is added to this the fact that different fisheries may require different statistical methods of deriving the boat catch averages, it can at once be seen that a boat catch analysis is not a simple problem.

The solid line in figure 22 shows the average daily boat catch of shad in each year from 1920 to 1925, inclusive, of twenty boats fishing in San Francisco Bay and its tributaries, and will serve as an example of the result of a simple boat catch analysis. Briefly, the average daily boat catch for each year was computed as follows: First, from the boat registration and ticket files, the names of twenty boats were taken which had fished for shad continuously during the years in question and had not changed their personnel or gear. This gave a constant unit of fishing gear with which to work. The daily catches of each boat were then tabulated, the record of each boat being kept separately.

As soon as the catches were tabulated, it was evident that some boats had catches which averaged much larger than the catches of others. This was due to some boats being larger, having larger nets or crews, or being operated by more skillful fishermen. Then if the catches as recorded had been combined and averages taken, the boats with the large catches would have had a much greater influence in determining the final averages than the boats with small catches. This is not desirable, since small fluctuations in catches of a boat which habitually makes small catches should be as indicative of the availability of fish to the fishermen as greater fluctuations in catches of a boat which regularly makes larger catches.

In order to give all boats equal weight in determining the final results, the catches of all of the boats were raised to a level so that their averages corresponded to the average of the boat having the highest average catch through the six-year period. This was accomplished by finding a factor for each boat, by which all catches of each boat were multiplied and thereby raised to an equal basis with the catches of the boat having the largest catches.

Since the catches of all of the boats were raised to a common level, the records of all twenty boats were combined and an average of the daily catches per boat computed for each year. This was done by dividing the sum of all catches of all of the boats for one year by the total number of catches occurring in that year. This procedure was followed with the data for each of the six years. The result is shown by the solid line in figure 22. The actual size of each catch for each boat, after being multiplied by its respective factor, and number of catches of each boat were used in computing the yearly averages, so each boat had a weight or influence on the final yearly averages in direct proportion to the number of catches that it made in each particular year. This is as it should be, because a boat making a hundred catches in a year furnishes twice as reliable a sample as a boat making only fifty catches in that year.

The final result then is the average catch per day or trip of a constant unit of fishing effort and gear for each of several years.

At this point it may be well to say that this paper does not pretend to be a complete discussion of the abundance of shad in our state. The graph shown in figure 22 is presented merely as an illustration of a boat catch method, and the statements that follow are in the nature of suggestions to show what can be done with boat catch data. The shad boat catch analysis was made in the course of an investigation of the abundance of striped bass, and we do not feel that enough work has been done on the shad data to warrant definite conclusions being drawn concerning the subject.

The boat catch curve indicated by the solid line in figure 22 shows that there was a sharp decrease in average boat catch from 1920 to 1921 and then a steady increase up to the close of 1925. This indicates that there was an increase in abundance of shad from 1921 to 1926. In order to verify this curve the economic conditions of the shad fishery during these years should be investigated. Prices for the different years and data on market conditions should be gathered and correlated with the boat catch curve.

Also, since salmon and striped bass are taken by the same boats on the same days that shad are caught, the condition of these fisheries should be studied, particularly prices, because a rise in shad prices and a drop in the prices paid for the other two fish might result in more fishing in places favorable for taking shad and so raise the size of the shad catches.

Another interesting phase of the problem is that in 1918 a protective measure, making a closed season on shad during part of their spawning season, went into effect. Therefore it may be that the first fish spawned in that protected spawning season returned in 1922 and helped to cause the rise in boat catch from 1922 to 1925, inclusive. Of course work to determine the age at which shad first appear in the commercial catch should be done to verify that supposition.

A boat catch analysis then is not a simple problem, but when carefully done and all of the biological and economic factors that might affect it are also worked out, it is a procedure that will yield the information desired by the Department of Commercial Fisheries and persons interested in the fisheries, and will furnish a definite measure of the abundance of the species of fish involved in the investigation.

AN HISTORICAL REVIEW OF THE LEGAL ASPECTS OF THE USE OF FOOD FISH FOR REDUCTION PURPOSES.

(Continued from CALIFORNIA FISH AND GAME, Vol. 13, No. 1, p. 17.)

By B. D. MARX GREENE, Attorney, California Fish and Game Commission.

At the conclusion of the previous article, certain cases were still pending in court. The owners of the two purse seine boats which had diverted food fish to the "Peralta" were contending that we had no right to condemn their purse seines. In the superior courts, however, of both Monterey County and Santa Cruz County, judgment was given in favor of the Fish and Game Commission condemning the nets. Thereupon, the owners of the two nets immediately filed petitions for writs of supersedas in the Supreme Court to prevent the court below from enforcing the judgment of condemnation. The two matters came on for hearing before the Supreme Court on May 3, 1927, and after argument, it was stipulated, owing to the perishable character of the nets, that they should be sold under an order of the court and the proceeds deposited with the court, pending the final determination of the right of condemnation. Subsequently, however, the petitioners consented to a dismissal of the actions and the nets were sold back to the original owners for the sum of \$1,450.

At the conclusion of the first installment of this article, the Alameda County court still had under consideration the injunction hearings brought by the Commission against the "Lake Miraflores." In this matter the temporary restraining order was finally dissolved and the defendant's demurrer sustained on the ground that the location of the vessel was beyond the three-mile limit and outside the jurisdiction of the courts of the State of California. This did not at all upset the theory of law enunciated by the Supreme Court and the United States District Court, but was decided upon the question of fact as to whether

or not the body of water in which the boat was anchored was a bay within the meaning of the constitution.

In December, 1926, the Globe Cotton Oil Mills of Los Angeles, which was in the business of manufacturing edible oil out of sardines, filed a petition in the Supreme Court for a writ of mandate against the Fish and Game Commission to compel it to hold a hearing to determine whether a permit should be issued to petitioner to use sardines for such purpose. The Commission had refused to hold such hearing, basing its refusal upon the language of the decision of Judge Stephens (CALIFORNIA FISH AND GAME, January, 1927, p. 11), which seemed to deprive the Commission of all its judicial powers, including that of holding hearings. The Supreme Court, however, decided in favor of petitioner, and handed down the following decision:

S. F. No. 12323. In Bank. January 20, 1927. *Globe Cotton Oil Mills, Petitioner vs. I. Zellerbach, M. H. Connell and Ralph H. Clock*, members of the Fish and Game Commission of the State of California, Respondents.

Application for writ of mandate prayed to be directed to respondents as members of the Fish and Game Commission to require them to act upon the application of petitioner for a permit authorizing it to use in its plant a designated quantity of fish. Writ granted.

For Petitioner—Warren H. Pillsbury, John L. Dyer.

For Respondents—B. D. Marx Greene.

BY THE COURT.

Upon submission of the cause in open court the chief justice announced the decision of the court as follows:

The petitioner, owning and operating a fish reduction plant at Terminal Island, San Pedro Harbor, seeks a writ of mandate to compel the respondent Fish and Game Commission to set for hearing and to act on the application filed with the Commission by petitioner for a permit authorizing it to use in its plant the quantity of fish designated in the application, for the purposes therein specified. The Commission has refused to entertain jurisdiction of the application upon the ground that it is a nonjudicial body, and that to act as requested by the petitioner would be to exercise judicial functions. In assuming this position the respondent relies upon *Van Camp Sea Food Co. vs. Fish and Game Commission*, 49 Cal. App. Dec. 38, in which it was held that a commission like the Fish and Game Commission, which is one having a state-wide jurisdiction, as distinguished from a local board, can not be invested with judicial functions, for the reason that, "except for local purposes," section 1 of article VI of the constitution confines all judicial power to certain specified courts.

This court is of the view, however, that admitting that the Fish and Game Commission can not be granted any power which constitutionally belongs exclusively to the judicial department of the state government, the granting of power to hold hearings and determine facts incidental to the regulation of fish and game, and to the granting of permits to take and use fish, is valid as an administrative or regulatory power, and in no wise transgresses upon the judicial functions of the judicial department.

Let the writ of mandate issue as prayed for.

This decision of the Supreme Court, while technically a defeat for the Commission, was in reality one of its greatest victories, because it restored to the Commission the right to hold hearings and determine quasi-judicially matters entrusted to it by the legislature in various acts.

Relying, therefore, upon this decision, the Commission immediately told all of the sardine packers in California that it would be necessary for them to file applications to have their capacities determined. Most

of the packers in southern California refused to comply with the order of the Commission, basing their refusal upon the former decision of Judge Stephens. The Commission thereupon commenced an injunction suit against the Van Camp Sea Food Co., Inc., alleging that they were operating their reduction works and using fish therein without having had the capacity of their canning plant determined. The matter came on before Judge Stephens upon an order to show cause, and was argued and submitted to the court upon a general demurrer filed by the defendant. On November 14th, Judge Stephens handed down his decision overruling the demurrer of the defendant and sustaining fully the position of the Fish and Game Commission. In effect, this second decision of Judge Stephens in the Van Camp case expressly overrules his former decision heretofore quoted.

The law therefore is now settled that all cannery must apply to the Fish and Game Commission to have their capacity determined. There is, however, no method left in the law by which the Fish and Game Commission is to determine such capacity, for the arbitrary allowance of 150 tons for each line of one-pound oval can closing machinery has been declared unconstitutional by the appellate court.

In the meantime, the Fish and Game Commission, in the orders determining capacity which it has heretofore made during the present season, has set out that the capacity of each canning plant is the amount of fish actually taken into such plant and canned. Each packer is, therefore, allowed to use for reduction purposes 25 per cent of his actual catch and not 25 per cent of a theoretical capacity of a plant. Furthermore, the Commission, in order to make the matter doubly certain, has adopted its General Order No. 6, defining waste of sardines, and in this order it determines that any use of sardines will be considered a waste unless a packer obtains out of each ton of sardines received by him at least fifteen cases of one-pound oval cans of sardines. Inasmuch as a packer can obtain twenty cases of such one-pound oval cans of sardines out of each ton of fish received, if the entire amount is fit for canning, it necessarily follows that this General Order No. 6 of the Commission allows the packer the leeway or margin of 25 per cent contemplated by the law.

After the decision on the demurrers in the Van Camp Sea Food case, the Commission filed injunction proceedings against three other packers at San Pedro who had ignored the Commission's order to have their capacity determined and had gone ahead with the operation of their plants. Temporary restraining orders were issued against these three packers and they were all kept closed for a period of days. Thereupon, all of the packers in southern California filed with the Commission their applications to have their capacities determined and appealed to the Commission to dismiss the pending litigation, agreeing that they would abide by the rules and regulations of the Commission and cooperate with it to the fullest extent. The Commission heeded the pleas of the packers and ordered the pending cases dismissed—and for the first time, practically, in the history of the state, there is now complete accord and amity between the California Fish and Game Commission and the sardine packers.

BIOLOGICAL REQUISITES FOR LAKE TROUT.*

By GEORGE A. COLEMAN.

The lakes of California range from nearly sea level to almost 12,500 feet in altitude. A great variety of conditions are produced as a result of such changes in elevation. Lakes lying in the lowlands are rarely if ever frozen while those in the high Sierra are beleaguered by the powers of winter for a great part of the year. Even lakes located at the same level above the sea vary. They have different depths and this factor, too, has a bearing upon the food supply of fishes and the conditions under which they live. Often sportsmen wonder when fish are planted in a lake why they are not forthcoming by the thousands. The reason is not so much a mystery as it would seem at first blush, for either the lake is unsuitable for fishes to breed in or the food in it is not adequate to support them.

The wind in passing over the surface of a lake sets up a wave action and produces a circulation that reaches a depth of from 25 to 40 feet. Hence, a lake with a depth of 25 feet has a circulation entirely to the bottom. Lakes of this character, where the whole body of water is influenced by the wind, are classed as shallow. Lakes of this type are also influenced by fluctuations of daily temperature. However, the deep lakes, those whose depth exceeds 40 feet, are subject only to seasonal changes in temperature. When a depth of 170 feet is reached the temperature varies only one degree Fahrenheit. Below this depth it is constant even though the surface may be 10 degrees warmer.

In general, the food of fishes is produced in a narrow fringe around the edge of the lake. The only place where plants and insects flourish is in the rocky or sandy margins where a strong wave action occurs. This area rarely extends more than 10 feet from shore so that the growth within the lake of plant and insect food for fishes is accordingly limited to a small portion of the water area.

Water insects and plants very seldom occur at a depth of greater than 25 feet. Occasionally they are found in deep water but not often. Light sensibly affects the growth of life in water as well as the other factors previously mentioned. At a depth of 250 feet only the lowest forms of plants have so far been discovered. Below this there is practically no light and darkness and lifelessness hold sway.

The United States Bureau of Fisheries made some experiments in keeping fishes at different depths. Pressure, of course, increases with depth and this represents another controlling factor in the well being of fishes. For instance, the bureau found that ordinarily fish will not live below 50 feet. Yet, in the face of this, fish have been caught in Lake Tahoe at a depth of 150 feet. This all goes to show that there is much undiscovered country in this field and that there is much we do not know about the habits of our lake fish.

Reproduction will not occur unless there is a sizeable breeding ground where the water is two to six feet in depth and conditions are right for breeding. Some fish require lake margins of a sandy nature, others prefer rocky situations. There must also be an adequate area

* Address given at Second Annual Convention, California Fish and Game Commission Employees, San Francisco, February 8, 1927.

where the young fish may feed. This must contain submerged and emerging vegetation and consist of some of the simplest and lowest forms of plants which will support the insect and microscopic life that serves as food for young fish. The area must be free from decay. Where there is decay there is disease. The perfect breeding and rearing ground is where production and consumption of waste are equal.

Oxygen is as necessary to a fish as it is to living forms out of water. Carbon dioxide is equally indispensable and must be present in a certain amount. In fact, the amount of carbon dioxide in the water is an index of its suitability and governs in no small degree the possibility of fish existing in this medium. By this, it must not be inferred that fish can not endure water slightly alkaline. They do best, however, in water slightly acid and poorest in water perfectly neutral. Curiously enough, if a fish is put in distilled water, which is perfectly neutral, it will die.

A hard and fast law of nature is that fish either must eat or be eaten. All their lives they are busily engaged in blithely devouring one another in order to preserve and continue their existence. Their appetites on the whole are very hearty and it takes a prodigious quantity of food to keep a fish in good health.

Of the plants that afford food, the algae are probably the most prominent. On the basis of color the fresh water algae fall into a general group called blue-green algae. These include the yellow-green and brown algae. These plants are of great economic importance as they supply oxygen for fish. They depend upon nitrogen in water for their growth, and certain microscopic forms, the diatoms and protozoa, in turn depend upon the abundance of the algae. A scarcity of the latter invariably results in a scarcity of the former. Nor is this the end of the chain for the invisible plankton, on which minnows live, depends on the diatoms and protozoa. Only a few of the crustaceans are important as fish food, though there are thousands of species and varieties. The fairy shrimps and the water fleas are the most noteworthy. Another item in a fish's bill of fare, besides water insects, is scuds. In the main, scuds are scavengers, living on decaying matter. Go around Clear Lake, where numbers of dead fish can be seen, and on examination it will be discovered that every fish is covered with thousands of scuds.

Tiny trout feel the hunger urge almost before the egg sac is absorbed. They begin to jump at gnats on the surface of the water and to take the larvæ of small insects as well as to devour the microscopic forms. Experiments have shown that trout but ten days old will take as many as twenty-five gnats in a single day. As they grow in size they take larger insects and their consumption of various sized prey is only governed by the size of their mouths. From the start they are cannibalistic. At first they will eat any other fish smaller than themselves. It makes no difference whether they be minnows, bass or trout as long as they can be captured. As they grow older, however, trout become more selective.

There is a constant trading around between bass and trout. Bass take great numbers of trout and trout devour bass up to a size that their mouths will permit. Due to the large size of the mouth of the bass it can take a trout almost as large as itself. In this respect the trout

is not so fortunate and must confine its attentions to bass much smaller than itself. There is no doubt that if a trout could swallow a bass as large as itself it would do it. Nature usually makes provision for this by producing a sufficient number of individuals so as to afford food for the various species that live off one another.

In conclusion it can readily be seen that no small problem is involved in planting trout in a lake and supplying them with an environment insuring their proper growth. At all times natural conditions must be obtained. If the balance of nature is upset or if conditions are not right for the plant, it can not possibly be successful.

PROGRESS IN HALIBUT INVESTIGATIONS.*

By RUTH MILLER THOMPSON.

Presenting a most absorbing account of the alarming depletion in the North Pacific halibut fishery, and of what is being done to save the industry, the *Pacific Fisherman* (July to October, 1927) devotes four major articles to a description of the scientific work being carried on for the International Fisheries Commission by Mr. W. F. Thompson and his associates. The author of this unsigned series speaks of this investigation as "without doubt the most thoroughgoing and valuable ever carried out in the field of commercial fisheries." Again, he refers to the "inconceivable mass of statistical and biological data" collected by the Commission's scientific staff, and says, "Though highly scientific in method, the investigation is along intensely practical lines, and is marked by close adherence to facts and avoidance of unsupported theory or speculation." This is high praise indeed, from anyone, and especially from a publication which is of the "trade organ" rather than of the "scientific journal" type.

It reflects great credit upon the judgment of both the commissioners themselves, in their executive capacities, and of those who framed the scientific program, that their work has been kept strictly relevant to their aims. It is also significant that in spite of the fact that the future recommendations of the Commission will very likely affect adversely various sections of the industry, the Commission's staff maintains the friendliest relations with fishery operators.

That quite the reverse of this situation has been and still is usual in fishery investigations undertaken in other countries could easily be demonstrated. There has often been a great gulf of misunderstanding between the "industry" and "science." This is despite many efforts on the part of investigative bodies to explain their endeavors to "practical men." In other days and places many articles have been printed and many public meetings held, similar to those conducted during November and December in Ketchikan, Prince Rupert, Vancouver and Seattle, by the International Fisheries Commission staff. Doubtless much of the unfortunate antagonism that has existed in some countries is due to the greater complexity of scientific problems presented by older fisheries, or to other factors beyond the control of scientists. However this may be, it is certain that the cooperation between research

* Contribution No. 69 from the California State Fisheries Laboratory, November, 1927.

and industry on the Pacific Coast points to an intelligent comprehension of each other's problems. If anything can prolong indefinitely the life of the halibut fisheries, this spirit ought to be able to find the way.

That California has made a large contribution to saving the halibut is a tribute to the vision of Mr. N. B. Scofield, head of the Department of Commercial Fisheries of the Division of Fish and Game. He was first to start scientific fishery investigation in this state and his continued enthusiasm made possible the employment of Mr. W. F. Thompson and the establishment of the California State Fisheries Laboratory under the latter's charge.

While Mr. Thompson was well fitted for his present work by previous training and temperament, and had gained valuable experience by conducting a preliminary investigation of the halibut in 1912-1913 for the government of British Columbia, it was as director of research for the California State Fisheries Laboratory that he developed his scientific talents. Undoubtedly his work on the sardine and albacore in California was a fine preparation for his return to the halibut research, and enabled him to think through its intricate problems with a masterly clearness.

Mr. W. C. Herrington, also trained at the California State Fisheries Laboratory, has recently been added to Mr. Thompson's staff.

While the basic facts of the halibut situation have already been unfolded, the conclusions presented in the *Pacific Fisherman* articles are of a tentative character. The commissioners have as yet made no report to their respective governments, and have reserved their recommendations until after the previously mentioned conferences with men from the industry. The commissioners, namely Mr. J. P. Babcock of Victoria, chairman, Mr. Henry O'Malley of Washington, Mr. Miller Freeman of Seattle, and Mr. W. A. Fould of Ottawa, have always taken a very active interest in the work of their scientific staff, and planned to be present at the public hearings.

Data indicating the actual abundance of fish on the banks which have been available to the Commission, include what is described as a "remarkably complete record of the commercial landings for the last twelve years," and logs kept by fishermen. During the course of the investigation, the system of record keeping has been still further improved and extended through the efforts of the scientific staff. The truly scientific character of the work may be judged from the emphasis placed on the necessity of adequate and continuous statistical records to the proper control of the fishery. This emphasis will recall the similar insistence that accurate and complete statistical records of catch are essential, which marked Mr. Thompson's work in California. Undoubtedly his appeal that research was futile without adequate statistics aroused the agitation which resulted in establishing the now famous "pink ticket" system in California.

Results obtained from a study of catch records and logs have been checked with painstaking thoroughness by comparison with data from other sources. Chief among these stand the observations of the Commission's employees aboard chartered vessels. For this work, a large and powerful halibut schooner, the "Dorothy," has recently been reconditioned and newly equipped to replace the "Scandia," which was

wrecked last February. The winter's studies of maturity, spawning, eggs and larvæ, and races have already begun.

The biological investigations based on all types of data have yielded harmonious results. That depletion has been very marked, though uneven, is clear. South and east of Cape Ommaney conditions are worst. Unmistakable signs of overfishing are: greatly reduced catch per unit of gear, a marked westward shift of fishing operations, and the preponderance of small fish in the catch. It is apparent that on the southern grounds the number of spawning fish is greatly reduced so that the present fishery is here a heavy drain on the immature population.

That the halibut stock of any bank is independent of the stocks on other banks, and must be protected by its own set of regulations, has been demonstrated. Studies of migration by means of tagging, of races by means of measurements of body proportions, and of age in relation to growth by means of "reading" the number of year rings on ear stones, give the chief evidences for the independence of fish stocks. Much remains to be discovered, especially concerning the large fish, before it will be possible to predict with certainty the effect of every proposed protective measure on the fish of each locality.

From the point of view of the actual ultimate needs of the fishery as scientifically determined, the essential part of any adequate regulatory law is provision for increasing or at least maintaining the number of spawning fish. Some "baby" halibut nurseries and spawning grounds in every general fishing area must eventually be closed. Each area must be handled as a unit in itself with its own conservation measures. Furthermore, to be effective, protection must continue for a long period of time, even permanently in some cases. Whatever legislation is adopted must be regarded as experimental. Therefore, not only must it be flexible and easily revoked should this be desirable, but its effects must be carefully followed. The necessity for adequate statistics is again apparent. If records are poor there will be no test of the value of regulation.

The study of the halibut is only half completed. To define the precise extent and degree of restriction needed on each bank will require considerable further work. Even when this is done, to determine the true results of regulation will be a task requiring the highest degree of scientific skill. It is to be hoped that the two governments will see the great value of the work that has been so ably begun and will realize that discontinuance would cause irreparable loss not only to the halibut industry, but to the future of fisheries research and to the cause of rational conservation.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California Division of Fish and Game.

Sent free to citizens of the State of California. Offered in exchange for ornithological, mammalogical and similar periodicals.

The articles published in CALIFORNIA FISH AND GAME are not copyrighted and may be reproduced in other periodicals, provided due credit is given the California Division of Fish and Game. Editors of newspapers and periodicals are invited to make use of pertinent material.

All material for publication should be sent to H. C. Bryant, Postal Telegraph Bldg., San Francisco, California.

January 30, 1928.

Consider your need, not your greed.



EUGENE D. BENNETT, NEW
EXECUTIVE OFFICER.

On December 1, 1927, Mr. Eugene D. Bennett of San Francisco became executive officer and attorney of the Division of Fish and Game, Department of Natural Resources. Although born in Kansas, Mr. Bennett came to California as a boy, where he learned to fish and hunt. During the World War he was a commissioned officer in the Ninety-first Division and a member of the division rifle team. His marksmanship was also demonstrated when he won a place on the

California state rifle team in 1924 and entered the national competition at Camp Perry.

Mr. Bennett has taken an important part in American Legion work, being past commander of San Francisco County Council and was formerly chairman of the Americanization Committee of the state department of this organization.

For nearly ten years Mr. Bennett has practiced law in San Francisco. During the past two years he has been chief deputy United States Attorney of northern California.

Even since childhood Mr. Bennett has fished and hunted and a definite interest in fish and game matters has long smoldered. In the acceptance of his new position this interest has been a determining point. Mr. Bennett believes that "never before has such responsibility rested upon the Division of Fish and Game as at present. It is of the utmost importance that the Division keep pace with the present rapid strides of its progressive development to the end that the state's great commercial fishing industry and also its outdoor and recreational resources of fish and game may be preserved and developed to take care of the state's ever-growing population."

THE RETIRING EXECUTIVE OFFICER.

To Mr. B. D. Marx Greene was given the important problem of reorganizing the work of the Fish and Game Commission, beginning January, 1926. To this work he brought administrative ability and boundless energy. In retiring he leaves the working force of the Commission acting under various departments and bureaus manned by competent men and the whole financed under a budget system.

Other administrative accomplishments include the reorganizing of the patrol force under a chief, two assistant chiefs and captains, and putting the warden force in uniform; the organizing and bringing to efficiency of a volunteer warden system; the establishment and maintenance of one of the largest game farms in the United States; efficient handling of pollution and screens and ladders; enlarged educational, research and publicity programs; a system of holding ponds and tanks for the ageing of trout; and the publication of a Service Bulletin and the holding of an annual convention for the education and stimulation of employees.

Mr. Greene's more recent interests have been centered in the development of a new and better system of fish distribution and in the use of a short wave radio in keep-

ing the patrol force in constant touch with the head office.

In all of the above accomplishments, Mr. Greene took an active part and his ability in better organizing the working force will be long remembered. Mr. Greene on December 1 assumed the position of attorney for the Department of Commercial Fisheries.

SPECIAL FISH PLANTING TRUCK.

During September a new Graham truck was especially equipped with ice boxes and aerating system for use in fish distribution. On its initial trip it proved so satisfactory that more emphasis will be given this mode of planting in the future. The first trip during the first eight days of October was in Mono

2. Those in charge can leave the fish to secure meals without danger of losing the fish. The reserve compressed air tank will continue to furnish air to the fish for thirty minutes, even when the engine is not running.

3. With fish in good condition, plenty of time can be given to proper distribution at the terminal.

The truck has continued to operate successfully from the Mount Whitney Hatchery.

A CORRECTION.

Due to the fact that the author of the article, "The Deer of California," which appeared in the October number of CALIFORNIA FISH AND GAME (Vol. 13, No. 4), did not see figures or legends for figures



FIG. 23. New fish distribution truck. Air tank on side filled by air compressor furnishes aeration to shipping cans. Photograph by H. C. Bryant.

County. The truck traveled over steep mountain roads and conveyed forty cans of black-spotted trout to Searles Lake, Alpine County. The shipment was on the road for nineteen hours. The distance covered was 255 miles. In some of the cans there were no dead fish at all. Apparently fish will travel any reasonable distance very satisfactorily under the conditions afforded by this truck. The outstanding advantages of this method of transporting fish are:

1. When properly iced, fish can be transported over a smooth highway as easily as over a rough road. Joggling produced by a rough road is necessary to furnish proper aeration when compressed air is not available.

in the proof stage, several errors appeared in the article.

Page 237. Transpose legends for figures. That is, for 52 read 53 and for 53 read 52.

Page 238. Lines two and three, "tailed deer and the white-tailed deer. The latter, the range of which is not shown on the distribution map, occurs in winter and only infre-" should read, "tailed deer and white-tailed deer. The latter occurs in winter and only infre-." Thus, the phrase, "the range of which is not shown on the distribution map," is to be omitted. Line four, word "northwestern" should read "northeastern." Also on page 238, the last line, "the state. (Range not shown on distribution map.)" should

read, "the state. (See distribution map, Fig. 57, p. 239.)"

Page 239. In legends to distribution map (Fig. 57), "*Odocoileus c. scaphiotus*" should read "*Odocoileus c. scaphiotus*." "5. Burro deer. *Odocoileus h. californicus*." should read "5. Burro deer. *Odocoileus h. eremicus*."—E. Raymond Hall.

COMMERCIAL DUCK CLUBS LICENSED.

At the 1927 session of the legislature a commercial gun club license act was passed in an endeavor to control the many commercial gun clubs that had been established where fees for hunting were

assured that these clubs will cooperate in the enforcement of the game laws.

Only a few commercial gun clubs are operating in southern California, the greater number being located in the Gustine-Los Banos district of the San Joaquin Valley and again in the vicinity of Colusa and Willows in the Sacramento Valley.

The following regulations have been issued by the Division of Fish and Game:

GENERAL ORDER No. 9.

REGULATIONS UNDER WHICH COMMERCIAL
DUCK CLUBS MAY BE OPERATED.

REGULATION No. I.

Shooting days limited to three days a

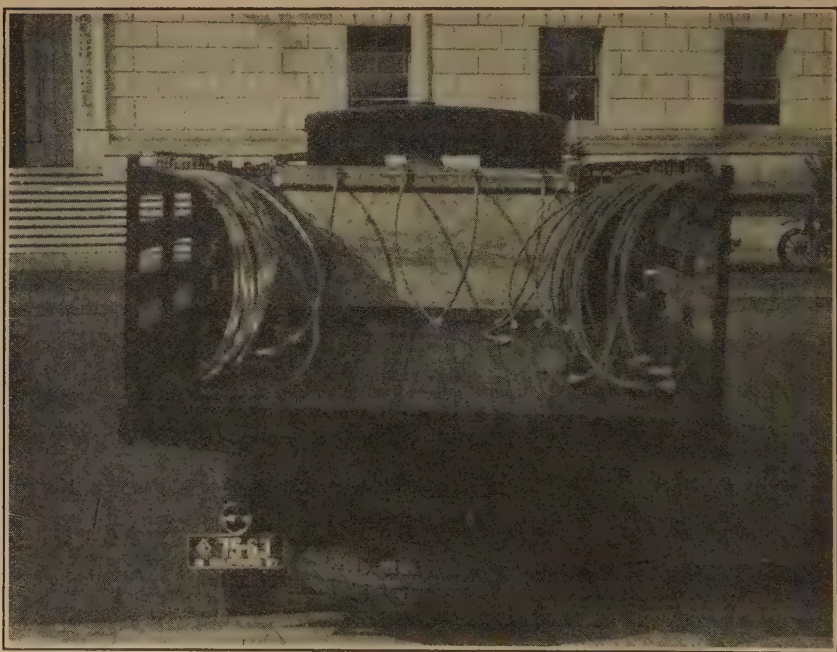


FIG. 24. New fish distribution truck showing aerating apparatus. Photograph by H. C. Bryant.

charged. The law provides for a license fee of \$25 to citizens and \$100 to persons not citizens of the United States. Each commercial hunting club operator must pay a \$5 license fee if he be a citizen and a \$25 license fee if he be an alien. Up to December 1, forty-three commercial duck clubs had been granted permission to operate and fifty-six operators were licensed to work on these preserves. The men who pay their fee and hunt on these commercial gun club grounds have found that they are better protected and the Division of Fish and Game is now

week; Sunday, Wednesday and Saturday. Additional operating days, the opening and closing of the season and all legal holidays.

REGULATION No. II.

A blind must be within shooting distance of water. Blinds must be a reasonable distance apart, to depend upon local conditions.

REGULATION No. III.

Each shooter must be given a satisfactory blind. No shooters to be allowed to hunt at large when blinds are full.

REGULATION No. IV.

Operators must cooperate with the Fish

and Game Commission in law enforcement.

REGULATION No. V.

Where clubs adjoin, no blinds to be located within 70 yards of adjoining boundary, except under mutual agreement.

REGULATION No. VI.

The continual shooting of birds out of range will be regarded as a nuisance and the club may at its discretion refund the money paid for shooting privilege and bar shooter from further hunting.

REGULATION No. VII.

Under no consideration is a club to guarantee limit.

The foregoing order is hereby approved and ordered filed as "General Order No. 9, Division of Fish and Game, of the Department of Natural Resources of the State of California."

Dated: This thirtieth day of September, 1927.

I. ZELLERBACH,
REGINALD FERNALD,
GEO. B. CLARKSON,

Fish and Game Commission.

Many requests have come from commercial duck club operators and hunters, who can only seek birds on these club preserves, that they be permitted to shoot every day during the week. After a thorough investigation of all angles in connection with the problem it was deemed to the best advantage of the hunters, the clubs and the ducks that the regulations as laid down by the Commission be enforced and that hunting be permitted only three days a week.

PATROL CONFERENCE.

Many important matters were discussed at a special conference of the patrol officers, held in San Francisco, October 10th and 11th. Captain K. P. Allred, acting chief of patrol, discussed general policies. As a better means of handling the large field force it was decided that each deputy will report directly to his captain and the captain directly to the chief of patrol. Thus there will be corrected the general tendency for men to go over the heads of their captains to the higher officers of patrol. Under this plan it is expected that the men will be able to work to the very best of their ability and accomplish splendid results.

KMN GOES ON THE AIR.

In order to increase the efficiency of the patrol service, the Division of Fish and Game at San Francisco has installed a 500-watt transmitting set, and with receiving sets a detail can be in almost constant touch with the head office. The station, known as KMN, is capable of sending messages to the remotest points in California both day and night. It has

an advantage over telephone systems in that it affords almost instantaneous service and there is no danger of the message being broken or "tipped off" as has been frequently the case with telephone calls. It will prove a valuable feature in regions where deputies are far from a telephone.

At duck headquarters for northern California, near Maxwell, a 100-watt transmitter has been set up. Here operators are constantly on duty and in ready contact with the central office. The ten men in the field at Maxwell are thus consistently informed in regard to developments and information received at the San Francisco office. In turn, the central office is advised of the needs of the men patrolling the duck fields, when a large haul is suspected and when relief deputies are wanted to check nightshooting. So excellent has been the patrol so far that no instance of a "drag" is known to have been made.

Another station has been installed at San Pedro and at the conclusion of the duck season it is the intention to remove the set at Maxwell to Sacramento. This will enable the three central offices to be in constant communication.

Another ambition is to equip the patrol with small portable sets and to instruct and train the deputies as to their operation. It is estimated that but three weeks, at most, will be necessary to teach a man how to take a message. Every deputy will have his own code letter. Messages will be sent from the central office at agreed periods known only to the field forces.

There is no doubt that the efficiency of the patrol will be greatly increased by means of the use of this modern invention. It is believed that this is the first instance in history that a patrol force has been directed by wireless.

KILL OF DEER, SEASON 1927.

A tabulation of the kill of deer in California has been made possible by the enactment of the Deer Hunting License Tag Act. This law provides that every person who hunts deer in this state must first procure license tags in addition to a regular hunting license. For a fee of one dollar, the hunter is furnished with two deer tags in duplicate; the original tag to be attached to a deer when killed and the duplicate mailed to the Division of Fish and Game.

The purposes of the new law are: (a) to make possible better enforcement of the laws for the protection of deer; (b) to secure accurate information on the number of deer killed; (c) and to provide additional revenue for field patrol.

The following report shows the number of deer killed during the 1927 open season. However, only a part of the data secured from duplicate deer tags is indicated; a full report will be published at an early date.

Game is importing from Czecho-Slovakia five hundred pairs of Hungarian partridges. A friend of conservation work who has been importing birds for his own use helped in making the arrangements. On arrival, these birds will be

DEER KILL'BY COUNTIES, SEASON 1927.

County	Points								Total
	2	3	4	5	6	7	8	9	
Alameda	171	42	7						220
Alpine	14	21	27	2	3				67
Amador	19	18	17	4	1				59
Butte	74	68	69	13	3	1			228
Calaveras	50	47	42	5	2	3			149
Colusa	161	76	25	1					263
Contra Costa	4	1							5
Del Norte	16	12	10	4					42
El Dorado	183	173	138	32	7	1		1	535
Fresno	215	170	159	32	12	2		1	592
Glenn	284	242	88	6	3				623
Humboldt	389	258	155	15	3	1			821
Imperial	1								1
Inyo	74	48	35	11	3	1		1	173
Kern	83	72	52	8	3				218
Kings		3							3
Lake	599	229	65	6	1	1			901
Lassen	20	86	129	37	14	3	4	3	296
Los Angeles	279	92	45	8	1				425
Madera	96	77	64	11	6	1	2		260
Marin	297	58	10	2					367
Mariposa	32	31	24	4	2	1	1		95
Mendocino	853	426	180	11	5				1,475
Merced	41	21	4	1					67
Modoc		138	262	69	24	10	3	4	510
Mono	14	7	10	5					36
Monterey	541	161	41	11	1	2			757
Napa	242	155	41	3	1				442
Nevada	38	48	36	3					125
Orange	24	17	12	2	1				56
Placer	121	105	95	14	4	2			341
Plumas	177	169	167	25	8	2	3		551
Riverside	170	82	51	19	1				323
Sacramento									
San Benito	150	54	10	2	1				217
San Bernardino	32	21	14	6	1				74
San Diego	95	38	33	3					169
San Francisco									
San Joaquin	13	7	1						21
San Luis Obispo	251	103	29	8	2			1	394
San Mateo	61	13	3						77
Santa Barbara	424	154	74	16	1				669
Santa Clara	243	119	31	4					397
Santa Cruz	69	6	3						78
Shasta	171	240	164	25	4	1	4	3	612
Sierra	27	27	44	2	1				101
Siskiyou	424	491	578	120	28	10	4	10	1,665
Solano	22	16	7						45
Sonoma	519	188	37	7					751
Stanislaus	53	26	8	3		1			91
Sutter			1						1
Tehama	286	288	192	29	2	2			799
Trinity	299	339	238	35	4	4			921
Tulare	341	200	177	24	1		1		744
Tuolumne	64	72	52	20	1	3		1	213
Ventura	164	74	27	7	2				274
Yolo	55	39	18	3					115
Yuba	24	19	6	4					53
Totals	9,069	5,687	3,807	686	157	52	24	25	19,507

HUNGARIAN PARTRIDGES
PURCHASED.

In the hope of furnishing still another desirable game bird for the sportsmen of California, the Division of Fish and

placed at the Yountville Game Farm to form the basis of a brood stock.

In British Columbia and the state of Washington, the Hungarian partridge has become well established and is fast becoming

ing a favorite game bird over a large area. Thus far, difficulty has been experienced in attempting to rear these birds under artificial conditions. However, the state of Oregon now has a brood stock that gives hope of better results in the future.

ASSOCIATED SPORTSMEN'S CONVENTION.

It is gratifying to all conservationists to find that at last the numerous fish and game protective associations of the state are united and pulling together to bring about better conservation of natural resources. The Associated Sportsmen of California held their third annual convention in San Francisco on November 3d and 4th. Representatives of the affiliated organizations were present and

TROUT DISTRIBUTION FOR 1928 PLANNED.

The present policy of establishing local hatcheries to care for nearby territory is proving a success. Time and energy are saved as well as losses in the shipment of fingerling trout. Well equipped auto trucks deliver the fish to the streams in splendid condition because of a short haul. The system can be made yet more effective by making all allotments of trout to the various streams in the fall in order that eyed eggs may be sent to the various hatcheries in proper quantities to care for each local district. Accordingly this is being done through a series of meetings with various captains of patrol. The needs of various districts are being ascertained and the allotments made. This



FIG. 25. Fish Car No. 01 arrives in Marin County with shipment of trout designed for Marin County streams. September 18, 1927. Photograph by Walter Sellmer.

there was much discussion on numerous and various subjects. As in past years, emphasis was placed upon the need for the destruction of predatory animals and the suggestion was made that the Division of Fish and Game put more lion hunters in the field charged with the additional duty of killing other predatory animals. A report on the reflooding of Lower Klamath Lake by a representative of the Bureau of the U. S. Biological Survey was not heartening. The concluding session of the convention was devoted to a display of motion pictures and to addresses by President Zellerbach of the Division of Fish and Game, B. D. Marx Greene, retiring executive officer, and Eugene D. Bennett, his successor.

having been done it will be an easy matter to allocate the proper number of eyed eggs to each hatchery and thus eliminate the long hauls which cause losses in trout shipments.

OUTBREAK OF DUCK DISEASE.

During the last days of October ducks died in large numbers at Buena Vista Lake, Kern County. It was estimated that at least two thousand birds lost their lives. In order of abundance the sick birds found were as follows: pintail, shoveller and greenwinged teal. Some mud hens were also affected. An investigation made by the Bureau of Research showed the symptoms to be similar to past outbreaks but when chemical analy-

sis was made of the water from Buena Vista Lake it was found to be in relatively fresh condition, the concentration of salts being very low.

In the study of sick ducks at Tule Lake, Modoc County, last year it was evident that temperature was a contributing factor in the occurrence of the disease. The appearance of the disease at Buena Vista Lake was preceded by hot weather. In the case of Buena Vista Lake there was a large percentage of decaying organic matter. Since laboratory experiments have demonstrated that gases such as those found where the disease occurs may be fatal to ducks, experiments designed to settle the question whether gas poisoning is concerned are being made.

A determination of the exact cause of this malady which has periodically swept this and other states is a necessity if waterfowl are to be conserved. The Division of Fish and Game is making a determined effort to solve this fundamental conservation question. It is indeed fortunate that Dr. K. F. Meyer, director of the Hooper Foundation for Medical Research of the University of California, has been secured to supervise this and other studies of disease by means of carefully planned experiments. It is expected that the mystery will be solved as soon as sufficient material is made available for study.

POT-HUNTING AND SHOOTING ETHICS.

In a certain place in Madera County where the land rises on end to meet the sky, two mountain masses come together forming a natural trap and affording but one outlet up a draw. Deer in considerable number frequent the region and it would be difficult to find in California a combination of circumstances more favorable for their slaughter on an incredible scale.

The tendency of man to devise means of killing game by wholesale methods is as old as the human race. In the day of the club and stone axe, man was ambitious to lay traps and to discover ways of gaining advantages over game that permitted of their easy and wholesale destruction. Such methods can be forgiven, considering the poorness of man's early weapons and the struggle he had to make to survive against the savagery of the world.

But a different principle governs the use of such methods today. The coming of the high-powered firearm has brought with it certain ethics in regard to its

right use. It is unsportsmanlike to shoot quail on the ground. It is taking an unfair advantage of ducks to shoot them on the water. It is equally beyond the pale of decent sportsmanship to "pot" a deer.

Unfortunately, an instance of deer "potting" on an extensive scale must be recorded for the opening day of the deer season. Some thirty men, employing a pack outfit of over forty horses, effected a "drive" on the deer in the region vaguely alluded to and enacted a day of slaughter seldom equalled in the present. The country was systematically combed. Those bucks attempting to escape up the draw met a shower of lead. Sentiment, not for a moment, swayed the bloody business and little thought was bestowed on the fact that others were being robbed of a sport, on the pursuit of which many writers have delighted to linger.

It is known that the law was not violated in any particular. The limit rule was observed and females and "spiked" bucks were not molested or harmed. The slaughtered were piled on a truck along with two black bear and the hunters merrily went their way leaving the country "shot out."

It is known, further, that some one thousand hunters were admitted to the region subsequently by the Forest Service, and that these, without hardly an exception, profited little by their long days of toil in quest of the very few bucks remaining. During the whole season the region gave a most pitiful reward to those who had enjoyed the sport of deer hunting in it in former years. Assuredly, such methods of killing game in California are to be uniformly condemned for their selfishness, their unfairness to the game pursued and their woeful want of sportsmanship.

WHAT IS A "FORKED-HORN"?

Is it legal to kill a deer with a fork on one side and a spike on the other? This is assuredly a very reasonable question and one which arises so obviously from a reading of the present law defining a "forked-horn" that there is good reason to answer the question here.

The present law reads, "any male deer with antlers of two branches on both sides shall be considered a 'forked-horn'" (Sec. 626e). The ambiguity springs from the fact that the law does not specify that a legal deer must have branched horns or antlers on *either* side. Hence, it is very likely that a judge considering the purpose and intent of the law would be most apt to recognize that any deer

without branched antlers on both sides would be an illegal deer.

NEW PLAN FOR DUCK CONSERVATION.

The failure of the Game Refuge-Public Shooting Bill at past sessions of congress has led to the formation of new plans that immediate results may be obtained. In the deficiency bill which awaits the present session of congress is a clause that provides, under the Phipps Bill, for an appropriation of \$350,000 to be used in the building of a dike across the mouth of the Bear River in Utah, as a means

Commissioner D. L. Madsen of Utah was appointed a committee of one to consult with the western states regarding any such proposals that may be submitted. By this action it is hoped that an adequate program may be initiated.

The Division of Fish and Game has adopted the resolution passed and is watching for additional opportunities to be of service in improving the situation. California has made a fine start by setting aside one-third of the hunting license fees to be used exclusively for the purchase and rental of refuges.



FIG. 26. Taking motion pictures of Hungarian partridges at State Game Farm. A blind was necessary to secure natural pictures of these wary birds. July, 1927. Photograph by Sidney Snow.

of holding fresh water on an area of about 200 square miles. The lake and marsh thus created probably will prevent the recurrence of the duck disease which has killed so many ducks in the past and will at the same time provide excellent nesting and feeding grounds.

At the meeting of the Western Association of Fish and Game Commissioners at Seattle a resolution was passed requesting the Secretary of Agriculture to submit proposals for creating and financing the necessary wild fowl refuges to care for the present critical situation.

The estimated kill of ducks in California is set at one million. Those in a position to know claim that the annual toll of the duck malady on Bear River marshes is a million ducks per year. Enactment of the Phipps Bill (included in the deficiency bill) will save ducks to the number of the estimated annual kill in California. Banded birds give evidence that 25 per cent of ducks that traverse Utah find their way to California during their migration. The reason why Californians should support this measure is evident.

AN ELK REFUGE NEEDED.

The elk, the largest game mammal of the west, was once very abundant in California. A census of the total number of wild elk left in the state would probably show less than five hundred animals. The last stand of the smaller valley elk is being made in Kern County where several hundred animals range back into the hills and then forage on the ranges near Buttonwillow.

Complaints as to the depredations of these animals have been frequent. For many years it has been clear that unless land could be purchased and an elk refuge established in this vicinity the state will soon have to add this famous game animal to its list of exterminated species. Several attempts have been made to stir

and December 1st, twenty thousand acres were disposed of in this region by the Miller and Lux Co. Marsh land in this area is selling at \$25 an acre and upland, from \$45 to \$75 an acre. The refuge should, of course, contain both lowland and upland.

Both federal and state officials are united in the belief that an elk refuge in the San Joaquin Valley is an important and immediate need. The matter of finance is the only factor which is preventing the solution of this problem. Somehow or other adequate means must be found for taking care of these wild elk in the San Joaquin Valley.

The Izaak Walton League recently raised \$36,500 by popular subscription, bought 1760 acres of land and presented



FIG. 27. Truck load of pheasants at Salinas on their way to the fields where they were planted. August 9, 1927. Photograph by Sidney Snow.

interest among the Order of Elks, but thus far no move has been made actually to furnish a satisfactory home for this final herd of elk. The U. S. Biological Survey has long advocated a refuge and recently Mr. E. A. Goldman, in charge of federal reservations, made a survey of the situation. He reports that a refuge should comprise at least four sections of land. This is hardly possible in Kern County because most of the marsh grounds are now under private ownership. Near Los Banos, Merced County, where there is considerable marsh land of the type formerly frequented by the valley elk, there is still an opportunity to secure suitable land. However, a purchase must be made quickly for between August 1st

it to the government to be added to the winter elk refuge in Jackson Hole, Wyoming. As a consequence, Yellowstone elk will find better winter pasturage and starvation in hard winters will be avoided. The critical situation in Wyoming has been improved. Who is going to improve the situation in California?

VOLUNTEER WARDENS.

The work of game wardens in investigating violations of fish and game laws is purely and simply detective work. It is work of criminal investigation, and as such it requires a fair knowledge of all the laws and of criminal procedure in the courts.

Without this knowledge a game warden is constantly groping in the dark and he never knows whether his actions will be approved or condemned when his cases are brought into court, where they must inevitably land. This point can not be too strongly emphasized. No matter how clever and energetic a warden may be in other ways, if he is ignorant of the intent and purpose of the law and criminal procedure, he will fail in the course of time. If he works in disregard of the laws, his activity is certain to get him into trouble. Therefore, he must be familiar with the law and the rules of criminal procedure in the court.

No special set of rules can be laid down for the reason that no set of rules will

of the state. The duties of sheriffs, constables and police officers usually end when they have apprehended a violator of the law, but that of a game warden has really just commenced after the arrest has been made. Then begins the trying stage. The warden now drops his role of "Policeman of the Woods" and assumes the role of prosecuting attorney. He has deprived a person of his liberty; now let him prove in a court of law that the said person has committed a crime—or by what right did he cause such person's arrest?

Herein will be shown the warden's fitness or unfitness. Whether the warden has used good judgment, is honest and has the requisite knowledge of what con-



FIG. 28. Arranging liberation of pheasants in the Salinas Valley. August 9, 1927. Photograph by Sidney Snow.

apply to all cases. Each case demands its own particular treatment and attention. However, it must follow that a game warden should possess some slight ability, either natural or acquired, as a detective. Each and every case demands the application of *common sense rules*, persistent effort, patience and careful attention in every detail, with the view always in mind that the enforcement of the fish and game laws must be clean, fair and just in all ways, and at all times, in order that the wardens may command the confidence, respect and support of the people.

In most instances the work and duties of game wardens are peculiar as compared with other law enforcement officials

stitutes legal evidence in a court of law, is now put to test. The warden may be honest and have acted in good faith, but, if he is ignorant of his full duty, in the eyes of the law, or has used poor judgment, he will be criticized and condemned. It behooves wardens to go slow at first and to feel their way, but there is no reason for an intelligent warden to hesitate if he is perfectly familiar with the laws for the protection of fish and game, and carefully and conscientiously performs his duties.

A game warden may feel perfectly certain within his own mind that a party is guilty of violating the fish and game laws, but that should have no bearing on the matter. The question is: Can the

warden prove the fact by competent legal evidence? Mere rumors, conjectures, prejudice and popular opinion should not interfere with the warden's judgment. Facts are what he is after and such facts as are relevant material and will support the warden's charge against the person arrested.

The quicker the warden learns his duty the better will he be able to do his work. As a rule, the real duty of game wardens is to educate the people as to the value and necessity of fish and game laws and to prevent violations of the laws, as much as it is to arrest those who violate the laws.

All volunteer deputies are advised to keep their own counsel relative to reported violations of the fish or game laws and not to openly discuss such matters.

When a volunteer deputy is confronted with any subject or matter relative to the protection of fish or game, the fish and game laws, or the enforcement of the laws, that he does not understand thoroughly, he should take up such matters with the commission and be guided by their advice.

While the Division of Fish and Game does not expect the volunteer deputies to be able to make frequent arrests for violations of the fish and game laws, it does want to know what each deputy has accomplished. Therefore, it is necessary and very important that all volunteer deputies comply with the instructions issued to them and render, either to their captain or to the field assistant, a monthly report of their activities. These reports should be made upon monthly report blanks which will be supplied.

With *activity* and *efficiency* the watchwords, and *cooperation* and *coordination* between the regular patrol and the volunteer deputies the key note all along the line, let us, one and all, put our shoulder to the wheel and make the volunteer deputy forces a body of men meriting and commanding the confidence, respect and support of the people in the efforts made to protect and conserve the state's supply of fish, game and wild life.—(Instructions issued to Volunteer Wardens by Walter R. Welch, Field Assistant.)

EDUCATION IN CALIFORNIA

The Fish and Game Commissioners began educational work in the schools in 1911 and 1912 when Miss Gretchen Libby traveled the state speaking to groups of children. The state is still reaping some of the benefits of Miss Libby's work.

Beginning on August 1, 1914, the work was reestablished on a more permanent basis and since that time bulletins for teachers and lectures at schools have been part of a well planned educational program. Few other states have had so uninterrupted a program as has California. Now work of this kind is recognized as fundamental by most states. The state of Pennsylvania launched a similar program a number of years ago and a questionnaire recently received gives an opportunity to summarize the present status of the educational work in California. The questions are those put by the Board of Game Commissioners of Pennsylvania; the answers those made by the director of the Bureau of Education of the Division of Fish and Game.

QUESTIONNAIRE.

Issued by the Board of Game Commissioners, Harrisburg, Pennsylvania.

Approximately how much money is available yearly for educational work?
\$23,317.

Do you present lectures throughout the state to sportsmen's organizations, schools, etc., and if so, how long has this method of education been carried on?

Yes, about sixteen years.

How many lecturers are carried on your staff?

Heretofore, but one. Beginning this month (September) two will be detailed for work in schools. Two part-time lecturers are employed for summer resort work.

Are the lectures illustrated with lantern slides and motion pictures?

Yes.

How long have you used motion pictures of wild life with your lectures? How long since your first motion pictures were made?

Thirteen years.

Do you photograph your own motion pictures?

Only a small part of them.

How many lectures illustrated with slides and motion pictures are presented in your state in a single year?

About 150 in past years.

Do you have live exhibits of birds and mammals? Are they located permanently in a museum or zoo, or are they sent throughout the state to county fairs, etc?

A few located at the game farm which are used at exhibits occasionally.

Do you have exhibition cases containing mounted birds and animals which you use in lecture work?

Not as yet, but plan to have. We have study skins of birds and mammals for loan to teachers.

Do you keep a photographic file of pictures of wild life, or other pictures of interest representative of your department?

Yes, we have both.

Do you have a collection of scientific skins of birds?

Yes.

Do your publications include an annual or biennial report or quarterly magazine, etc?

Both.

Do you publish bulletins or pamphlets dealing with the life history of the birds and mammals representative of your state, and if so may we have a list of same?

Yes. A series of Fish, Game, Teachers and miscellaneous bulletins.

Do you maintain a separate bureau in your Game Department for purely educational work? If so, when was this bureau inaugurated?

Yes. 1914.

How was the work carried on prior to the inauguration of an educational bureau?

School lecturer, 1910-1912. Bureau of Education established in 1914. (See report of the Bureau of Education in last Biennial Report.)

EXPRESS SHIPMENTS OF DUCKS INSPECTED.

Before the sale of ducks was stopped it was difficult to keep track of the various shipments arriving in the large cities. At present it is proving dangerous for anyone to ship more than a limit of ducks by express. (Parcel post shipments are prohibited by law.) A deputy detailed to investigate all shipments of game arriving in San Francisco has apprehended a number of violators who ship more than a legal limit to their homes.

TAHQUITZ GAME REFUGE.

After many years of endeavor a sizable area has been set aside in the San Jacinto Mountains which is known as the Tahquitz Game Refuge. Here a large number of southern mule deer will find satisfactory protection. This new refuge is well situated; on the north and east it is practically inaccessible to man, with no roads or trails. On the south and west only three trails lead into the refuge. The only person living within its boundary is the lookout of the United States Forest Service, located on Tahquitz peak. This lookout is cooperating heartily with the Division of Fish and Game and is in a position to hear practically any shots fired within the refuge. An abundance of water, fine feed and cover help to make conditions ideal. Deputy Robert J. Little on a recent visit to this region reported seeing seventy deer and many tree squirrels and mountain quail.

OPENING OF DUCK SEASON ENCOURAGING.

Pessimism has reigned in California for several years regarding the status of ducks. Sportsmen have continually complained of few birds. The fall season of

1927 opened on October 1 and reports from the duck country have justified the hope that the present season will be a nearly normal one. Early rains furnished considerable overflow land and ducks appeared in numbers. A splendid flight was reported from the Imperial Valley and limit bags were the rule in the San Joaquin Valley.

FISH PLANTING.

Old timers love to tell of conditions a decade or so ago when it was the usual thing to catch hundreds of pounds of trout in a single day. But trails were few in those days and very difficult to travel. Bridges were wanting, all modern conveniences were absent and a trip into the high country often involved much of hardship and danger. Now with new trails built and old trails improved, so many resorts furnishing pack outfits at reasonable rates and means of rapid locomotion ever at hand, more fishermen are present along the mountain streams than during whole summers in the early days.

All this increased activity of anglers augurs an enormous drain on the streams and means that fish planting must be on a scale of equal magnitude. Indeed few anglers realize the enormity of the task that has devolved on the division to keep the streams replenished with gamey fish. Over 19,184,000 fish were planted from the hatcheries this year. Truly this is an achievement. Nor should it be forgotten that literally thousands of black bass, crappie, perch and catfish were rescued from overflow waters and pools fast going dry and placed in live water.

SAGE HEN GIVEN PROTECTION.

Game Refuge 1-Q, located in Lassen County and created by the state legislature last year, is a boon to the future of the sage hen. It accorded them adequate protection this year and it is reported that there are now some five thousand birds at Painter Flat. These are increasing and will stock the adjacent area.

It is reassuring to know, further, that stockmen are materially aiding in the good the refuge is accomplishing by keeping their gates locked so that hunters find the refuge difficult of access and do not get into the refuge innocently at night. They are further contributing to the welfare of the sage hen by warning hunters of the prohibited area. As an instance of this, one occurrence is of worth to note here. The refuge is approached from the Nevada side by way of Upper Smoky Creek. Riders from the Secret Valley Ranch were stationed on

the road on the opening day to inform the Nevada cars that they could not hunt in the refuge. At least twenty-five cars with their respective occupants would have taken toll of the sage hen had it not been for this splendid cooperation.

A FAMOUS ANIMAL BLIND.

Bull hunting, a spectacular method of slaughter, is now a thing of the past. One is no longer able to go out into the back country and watch a market hunter "walk his shot." Furthermore, there are few recorded accounts of the animals and methods used in this sort of hunting. As a consequence it seems worth while herewith to give a photograph of "Old Tom," most famous of the hunting steers.

license law went into effect, two new speed boats manned by trained deputies will protect ducks in two of the great hunting spots of California.

A Johnson aquaplane, equipped with a high speed outboard motor capable of 18 miles an hour, has been placed on Morro Bay, while another boat identical in construction will be used by the fish and game patrol on the famed Salton Sea in Imperial Valley.

Morro Bay in San Luis Obispo County and the Salton Sea, unique inland ocean in the Imperial Valley, are famous for ducks. In years past violators of the game laws have frequented these places and made great hauls by motor boat due



FIG. 29. "Old Tom" a famous hunting steer of the olden days when "bull hunting" was legal. This animal weighed 1850 pounds and made an excellent blind because of its size.

"Old Tom," because of his training, his size, and build, made a most satisfactory blind. When he was sold to his owner, P. A. Blackburn, of San Bernardino, in 1914 he weighed 1850 pounds and stood 5' 8" high. During the days of market hunting "Old Tom" was utilized in practically every inland county of the state. This assistant of the market hunter, although concerned in extensive slaughter, deserves none of the blame to be heaped upon those who take more than their fair share of the state's game supply.

TWO SPEED BOATS ADDED TO PATROL.

Carrying out the program of progressive efficiency promised when the new

to the fact that the areas were not properly patrolled. But now that the deficiencies of patrolling these watery areas are removed by the addition of this equipment to the Patrol Department's resources, and with men on duty day and night, adequate law enforcement is made sure.

RESOLUTIONS OF WESTERN ASSOCIATION.

The Western Association of State Game Commissioners held its seventh annual meeting at Seattle, Washington, on September 8 and 9, 1927. Many important questions relative to fish and game conservation in the western states were discussed. The general attitude of the meeting toward a number of problems is

indicated by the following resolutions which were passed:

I.

Whereas, this association and conservation in general has lost a valuable and esteemed friend in the passing of the late C. A. Jakeway, who was a charter member of the organization; therefore, be it

Resolved, that we do hereby express to the family of Mr. Jakeway, our sincere sympathy, and assure them that his name and good work will long be remembered by his associates in conservation; therefore, be it further

Resolved, that this resolution be spread upon our minutes and a copy sent to the family of the deceased, and to each member of this organization.

II.

Whereas, the water area suitable to waterfowl has been greatly decreased through reclamation, drainage, and evaporation; and

Whereas, there is great need for the establishment and maintenance of refuges for the perpetuation of migratory waterfowl in the United States; therefore, be it

Resolved, that the Western Association of State Game Commissioners favors enactment of legislation for the establishment and maintenance of said migratory bird refuges.

III.

Whereas, the long continued mortality among migratory birds in the Bear River marshes is seriously affecting the abundance of these birds in Western America; and

Whereas, the restoration of these marshes would effect the saving of many thousands of migratory birds annually; and

Whereas, said restoration is both feasible and practical; therefore, be it

Resolved, that the Western Association of State Game Commissioners commends and urges the immediate passage of the Phipps measure, which has for its purpose the appropriation of \$350,000 to be expended by the federal government in the restoration of these marshes.

IV.

Whereas, the reclamation of Lower Klamath Lake has destroyed a great habitat of migratory waterfowl; and

Whereas, the reflooding of Lower Klamath Lake is both desirable and urgent; therefore, be it

Resolved, that the Western Association of State Game Commissioners hereby favors the introduction into congress of the United States of a bill proposing the appropriation of — dollars, for the purpose of reflooding Lower Klamath Lake. Be it further

Resolved, that the president of the association is hereby directed to appoint a committee of two to prepare or have prepared the draft of a suitable bill and submit the same to the states comprising the membership of this organization for their approval. Be it further

Resolved, that the committee of two is hereby authorized to confer with and solicit support from all other conservation organizations in America in carrying out the purpose of this resolution and to pledge the support of the Western Association in securing the passage of such legislation as may be determined upon.

V.

Whereas, the Western Association of State Game Commissioners has by resolution favored the creation of migratory bird refuges; and,

Whereas, the need of this action is urgent; therefore, be it

Resolved, that the president of this association be directed to request the United States Secretary of Agriculture to prepare proposals for financing and creating such refuges and submit the same to a committee of one, which the president of this association is hereby directed to appoint. Be it further

Resolved, that this association favors plans for financing said projects in the following respective order:

1. Federal appropriation.
2. Federal appropriation supplemented by state appropriation.
3. Federal hunting licenses.

Be it further

Resolved, that the respective states comprising the membership of this association be requested to furnish to the committee of one an estimate of their requirements for refuges and the approximate cost thereof. Be it further

Resolved, that the committee of one is hereby instructed to confer with the states comprising the membership of this association for the purpose of determining upon the projects proposed. Be it further

Resolved, that the committee of one is hereby authorized to confer with and solicit support from all other conservation organizations in America in carrying out the purpose of this resolution and to pledge the support of the Western Association in securing the passage of such legislation.

VI.

Whereas, the American Fisheries Society and the International Association of Fish, Game and Conservation Commissioners have elected to hold the 1928 convention in the city of Seattle; therefore, be it

Resolved, that we believe that the best interests of conservation would be served by a joint session of these organizations and the Western Association of State Game Commissioners, and we therefore respectfully tender the full cooperation of the membership of this organization to participate in the program and activities of their convention in such manner as they may determine, and we pledge our hearty support in making the joint convention a success. Be it further

Resolved, that we authorize our incoming president to invite the conservation agencies of our friends across the border to participate in the deliberations of this convention in such manner as may best suit their convenience.

VII.

Whereas, the Honorable Roland H. Hartley, governor of the state of Washington, and the Honorable Bertha K. Landes, mayor of the city of Seattle, have evidenced their keen interest in conservation by giving hearty support to the success of our convention; and

Whereas, the very able committee on arrangements has contributed so largely to our comfort and convenience; and

Whereas, the Chamber of Commerce and the press of the city have accorded us such excellent publicity and support; and

Whereas, the management of the Olym-

pic Hotel has furnished every facility required for our meeting; therefore, be it
Resolved, that we extend to these persons our sincere thanks and appreciation.

VIII.

Whereas, S. F. Rathbun, our worthy president, has transacted the business of this association in a proper and most efficient manner, and has unselfishly given unstintingly of his time and effort thereto; therefore, be it

Resolved, that we do now extend to President Rathbun our thanks and appreciation for his efforts during the past year which have resulted in a better understanding of our mutual problems, and especially do we commend President Rathbun for his preparation for this meeting which has made the seventh annual convention the most successful in the history of our organization.

GOVERNMENT TO TAKE WATER-FOWL CENSUS.

There has been much discussion whether the general complaint relative to the scarcity of ducks can be supported on the basis of actual census figures. There are too many loose statements concerning the comparative abundance of various game species. In order to bring together some real data relative to the abundance of waterfowl, the United States Biological Survey is asking the cooperation of sportsmen and bird students throughout the United States in the taking of a census. Instructions are given to each observer to select the best area in his vicinity. This is to be covered in a single day on the same day of the month for each month of the year. It is hoped thereby to obtain some accurate information on this much mooted question. From these data it is hoped to bring to light some of the causes of local fluctuations and facts relative to migration.

HABITS OF THE CALIFORNIA CLAPPER RAIL.

One of the important notable contributions to the life history and habits of a game bird are to be found in the November-December number of the *Condor*, under the title "The California Clapper Rail, its Nesting Habits, Enemies and Habitat," by Dudley Sargent DeGroot. The author gathers together much valuable data relative to the number of eggs, nest location, nesting material and time of nesting. The latter part of the paper discusses the causes for the disappearance of the clapper rail. The following are listed: enemies, encroachment of civilization, Norway rat, mussels and predatory animals. After suggesting the possibility of domesticating and distributing clapper rail to other marshes, the attention is called to the recent reclamation project which will

destroy more than four thousand acres of the best rail marshes located on the San Francisco bay shore, between Belmont and San Carlos.

MAINTENANCE OF WILD LIFE ON RESERVATIONS.

With the settlement of the country, involving the removal of forests, the drainage of marshes and water areas for cultivation, the building of towns, and the construction of roads, together with excessive killing by hunters and inroads by predatory animals, the game and other useful wild life early disappeared from many sections. Public opinion is now, however, becoming aroused to an appreciation of the economic, recreational, and educational values of the presence in reasonable numbers of many forms of wild life. This has given a real impetus to conservation, and experience in wild-life administration has demonstrated the practicability not only of saving the remnants of our animals and birds but through restocking measures to restore them to territory long depleted. A commendable zeal to conserve game and other forms of wild life has in a few places even resulted in a surplus. Game-administration programs should, therefore, provide for the maintenance of a suitable number of breeding individuals and the utilization, ordinarily through hunting, of any surplus that may accrue.

The reservations under the jurisdiction of the Biological Survey include four fenced areas primarily used for buffalo, mountain sheep, antelope, and other big game; a winter elk refuge in Wyoming; the Upper Mississippi River Wild Life and Fish Refuge; the Curry Game, Bird and Fish Refuge, Alaska; the Alaska Railroad Muskrat and Beaver Refuge, Alaska; and sixty-eight other areas in the United States, Porto Rico, Hawaii and Alaska that are primarily bird refuges. Some of these widely scattered bird refuges are notable island colonies, containing interesting species not found elsewhere, and the need of extending them special protection to prevent extermination is vital.—Ann. Rpt., Chief, Bureau of Biological Survey, 1927, pp. 14-15.

PHEASANTS AND CATS.

The ringneck pheasants are increasing as well as can be expected when one takes into consideration what this wonderful game bird has to go through even to exist. I am daily in pheasant country and have had the opportunity to watch and to study this bird. The delta land, where the pheasant thrives best, consists

of the best land that California has and is therefore all under cultivation, with the exception of a few islands. It is noticeable that the birds are a little more plentiful on these uncultivated islands.

Thousands of nests are destroyed annually by mowing machines, rakes, cultivators and different implements used to till the soil and harvest the crops, for a large percentage of these birds like to nest in the growing alfalfa, corn and barley fields, although there are many levees and sloughs where they do nest. Then there is the common house cat that is one of the greatest destroyers of young pheasants and quail. It is not so strange when you view the cat situation as it is that which proves to be such a menace to these birds. It should be taken seriously. The cat has gradually been planted on our islands, much as the Commission has planted pheasants and other game birds.

First there are the farmers and people living in town who haven't, as they say, the heart to drown small kittens, and finding them a nuisance, take them in the car and drop them along the road in some out of the way place. Furthermore, there is the delta tenant who moves out of a camp and leaves the cats to shift for themselves. I have often seen these cats along the road in the evening. I had a house cat at my home that killed two quail, less than a half a mile apart: one was found partially eaten beside her nest of sixteen eggs, and the other within a few feet of her nest of twenty-one eggs. I saw this and know that this one cat destroyed two coveys of quail inside of two days. Later I came upon another cat eating a young pheasant about the size of a quail. These cats were killed, and I have declared war on all the cats that I find in the field, and up to date have killed quite a few.

The planting of cats in this innocent way has given this animal such a start that it will take more than one game farm to produce enough birds to feed these cats. Many of the delta farmers are foreigners, who have made it a practice to hunt and trap these birds, but they are taking notice of our good judges who can say \$100 or \$500 just as easily as the judge, a few years back, said \$25.—D. E. Roberts.

A COSTLY LESSON.

One Lassen County man who shot a doe and entertained secret ambitions to "out smart" the law, completed arrangements with Judge Taylor of Taylorville early in November to pay his \$400 fine

in monthly installments. Deputy Walter I. Long of Westwood took the case nearly two weeks after the act had been committed. He learned that two fawns had starved to death as the result of the slaughter of their mother. The tragedy persisted in his mind with a strange fascination and he determined to make the best of the scanty information that had come to his ears.

Finally, through two farmers who were sufficiently incensed over the distress of the fawns to be willing to tell all they knew of the matter, he succeeded in gathering in the remaining facts necessary to his case. At first, the doe slayer denied the charge, but when faced with the evidence that the deputy had gathered so carefully, he plead guilty.

There are times and occasions when severe fines, though they impose a very serious burden on the offender, are necessary because of the reprehensible nature of the offense. The exposure of the two fawns to the many perils of the wilderness by the removal of their mother; even their lingering death by starvation, might be viewed with some indifference, if the doe had been killed by a man whose family were on the verge of perishing for want of food. But in this case the killing was wholly wanton and Judge Taylor probably was of the opinion that the offender's lack of sportsmanship and failure to keep the law could best be corrected by a severe fine. Inasmuch as the doe slayer could not pay the entire fine, he was ordered by the court to pay \$50 a month over a period of eight months.

THE FOOD OF FISHES.

The source of subsistence of fishes inhabiting the vast expanses of the sea has excited man's keenest interest. This springs partly from a desire to know what is hidden beneath the waves of the ocean. While it is possible to see fish sporting about beneath the surface, rarely is the secret of their livelihood revealed. To discover this, scientists have tediously examined samples of sea water with high-powered microscopes, strained the water through fine cloth or filter paper and availed of all manner of methods to satisfy their curiosity as to the kinds of living things which serve as food for marine fishes.

Dr. W. E. Allen in the *California Monthly* (Vol. xxi, No. 2) gives an account of the study now being made at the Scripps Institution of Oceanography of the plankton, a general name applied to floating animals and plants resident in

the sea that fall victims to fish. In describing the host of creatures composing the plankton group, Dr. Allen writes:

"Obviously, a term as sweeping as this includes a wide variety of organisms some of which live suspended in sea water throughout their existence while others live as plankton through only a brief period of their lives. For example, very young barnacles, mussels, and starfishes may be found in the plankton inshore, at times, but they live on, or are even fixed to, solid objects over a much longer period after they have reached the adult form.

"Some species of animals and plants are free-floating or free-swimming throughout indefinite numbers of successive generations. They constitute the permanent plankton. Others, including fish eggs and very small fish fry, belong to the plankton for only a few days or weeks. They constitute the temporary plankton, or rather the temporary components of the plankton. Some organisms, such as jellyfishes, belong to the plankton only during a sexual generation, the preceding and following generations being fixed to solid objects in much the same way as sea weeds. In general, they constitute only a small part of the temporary plankton, although in certain localities they may swarm in such numbers as to be almost all of it for a few days.

"Plankton consisting of individuals large enough to be seen readily with the unaided eye is called 'macroplankton.' That which requires the use of a microscope for effective study is called 'microplankton.' That which can be studied only with very high powers of the microscope is called 'nanoplankton.' The bacteria are included in it. Animal plankton is called 'zooplankton' and plant plankton is called 'phytoplankton.'

"None of the animal components of the plankton can manufacture foods from raw materials of air and water (including dissolved and suspended salts and gases). They must feed upon other animals or upon plants or their products. Some plankton animals are able to feed on sea weeds or fragments of sea weed, but most of them are finally dependent upon the plants of the plankton.

"Of these plants, diatoms are most widely distributed and, apparently, most important by reason of their power to manufacture living substance from raw materials, and by reason of their usefulness as forage for animals. Diatoms are microscopic plants which usually give no evidence of their existence to our unaided eyes. But there are times when they swarm by countless billions over hundreds of square miles of sea and to some scores of yards beneath its surface.

"In general, it may be said that the plankton in all seas tends to reach greatest abundance in the spring of the year. This is particularly true of plants, although it has not yet been shown to be a fully dependable rule. Many links in different food chains have been traced, for example, the use of diatoms for food by copepods (tiny shrimp-like animals in the plankton mentioned above), of diatoms and copepods by fishes, of smaller fishes by larger fishes, and so on.

"In southern California it has been found that great variations in production of diatoms may occur in successive years and in different localities. In favorable localities and under favoring conditions

diatoms may be found in numbers of several million cells to the liter (about a quart). Plankton organisms tend to occur in swarms just as strongly as fishes tend to occur in schools. The sea sometimes shows reddish, brownish, or yellowish hues for many miles because of the abundance of certain plankton organisms which have found living conditions exceptionally good. Coastal waters, upwelling waters, and Arctic seas in the summer season have been found to show high productivity as compared with other waters. There is increasing evidence that conditions of drainage from land into the sea may have great influence on the productivity of neighboring oceanic territory. For example, at the Scripps Institution of Oceanography it is considered probable that reduced and severely controlled drainage in southern California in the last several years is partly responsible for the lower production of plankton and of commercial fishes.

"Not only are components of the plankton most favorable amongst marine organisms for studies of fundamental conditions of origin and maintenance of life in the seas of today, but they are also highly important in furnishing clues to conditions of life in the past. For example, both living and fossil diatoms and foraminifera are being extensively studied for information concerning the conditions in the sea under which certain marine deposits were formed. They are also used by stratigraphic geologists as an aid in the location of petroleum deposits. Since it appears that these minute organisms contain material which may be the mother substance of petroleum, they are also being studied in connection with the investigation of the origin of possible source beds of petroleum."

COURT DECISION DIVIDES JURISDICTION OVER KAIBAB DEER.

In connection with the plan to reduce the number of deer on the Kaibab game preserve in northwestern Arizona, a conflict arose between the United States Forest Service and the state of Arizona as to the issuing of hunting licenses. When the Forest Service proposed issuing special licenses to hunters to kill a certain number of deer, the state authorities objected, claiming the deer of the Kaibab were under state jurisdiction. When the matter was carried to the United States District Court of Arizona the court granted a perpetual injunction against the state officials from enforcing the game laws of Arizona against "officers, agents, servants or employees of the United States on account of anything done by them in carrying out the regulations or orders of the Secretary of Agriculture relative to reducing the number of deer in the forest or game preserve." On the other hand, the decision provided that "this decree shall not be construed to permit the licensing of hunters to kill deer."

LION HUNTER BRUCE BREAKS RECORD.

That State Lion Hunter Jay Bruce has been especially active the past year is demonstrated by the thirty-nine lions killed up to December 1st, and with a chance of adding several more during the month of December. His total kill to date has been 324. Mr. Bruce accounts for the bettering of his average of thirty being due to the assistance in camp furnished by a friend. With someone who could drive the machine and meet Bruce at some other point, much time has been saved.

MOSQUITO FISH A SUCCESS.

One of the latest fishes to be successfully introduced into California waters is not a food or game fish, but a small top minnow known as the mosquito fish, introduced to help in the control of malaria. Heretofore, the cure of malaria has depended primarily on the skill of a physician in poisoning the malarial parasite which works in the blood corpuscles, with the least damage to the human body. The salts of quinine secured from a Peruvian tree has been most successfully used. A recent paper entitled, "The Mosquito Fish (*Gambusia*) and its Relations to Malaria," by David Starr Jordan (Smithsonian Report, 1926, pages 361-368, 4 pls.) points out that attention is now being given to prevention rather than cure. Anything which helps to destroy the carrier of the disease, which has been proved to be certain mosquitoes, is real prevention. The small top minnows from the coast streams of eastern Mexico eat the eggs of the "wrigglers" of disease carrying mosquitoes. Immediate success was obtained in acclimatizing this fish in California and worthwhile results are claimed by those interested. The success here has caused the introduction of the same fish in Hawaii, Formosa, Philippine Islands and more recently in Spain, Italy and Albania.

SEASHORE ANIMALS OF THE PACIFIC COAST.*

These days there are increasing numbers of people who find recreation along the seacoast. Not only are the sandy beaches chosen, but the rocky cliffs and tide pools are explored. Many there are also who inspect the wonders of the deep through glass-bottomed boats. To all

such comes the constant question, "What is that beautiful sea animal, what are its near relatives and what its habits?" Though the shell collector has had the handbook of Josiah Keep, "West Coast Shells," those interested in other animal life could find no book to which to turn to find dependable information. There has been a real need felt by western naturalists, teachers, leaders of scouts and visitors at the beaches for a readable, fully illustrated account of the common seashore animals of the west coast. This need has now been filled through the publication of a sizeable book entitled, "Seashore Animals of the Pacific Coast," by Myrtle Elizabeth Johnson and Harry James Snook. The authors discovered the need and made their plans while doing graduate work in the Zoology Department of the University of California. Through the years, though busy teaching in two widely separated parts of the state, these two authors through summer studies at various biological stations and independent work have brought to completion this splendid volume. Eleven colored plates give evidence of the beautiful colors which nature has evolved in living organisms that find their home about the reefs, rocky beaches and sandy patches of shore. Seven hundred additional illustrations help the reader to visualize each form of animal life.

Every rocky point that juts into the surf is a natural museum. Crevices in the rocks and the mat of seaweed afford shelter for numerous forms, while the hard rocks give places of attachment for those animals that lead a sedentary life. Nearby the outgoing tide leaves pools in rocky basins which form traps for shrimps, fish and other purely aquatic forms. With this newly published book in hand, one may segregate the various forms according to their relationships and find the correct names for them and learn of their distribution and interesting habits. Though great care has been taken to make the book scientifically accurate, it is designed for use by all those interested in sea life whether they have a zoological vocabulary or not.

Anyone interested in fish and game and its conservation will find of value the paragraphs relating to such game species as the edible crab, the spiny lobster and the various edible clams. A cursory review will bring to light such interesting facts as the following: The red abalone produces annually from one to two million eggs. Yet in spite of this the number of abalones have so decreased in recent years

* Johnson, Myrtle Elizabeth, and Snook, Harry James, 1927. Seashore animals of the Pacific coast. (The Macmillan Company, New York), xiv, 659 pp., 11 col. pls., 700 figs. in text.

that special legislation has been necessary in the effort to conserve them. The spiny lobster produces a quarter million eggs and the young have a curious larval existence. The flattened condition of the body has given them the name of phyllosome (leaf body). Artificial propagation has as yet been unsuccessful. One kind of starfish is so common a food of other animals that seldom is an individual found with all of its rays. Thirteen species of shore sponges are commonly found on the California coast. They seldom resemble the sponge of commerce, which is only the skeleton of this animal. The "rubberneck" clam or gaper is a conspicuous inhabitant of the mud flats of Tomales Bay. Though it lives two to four feet below the surface, long siphons connect the animal with the water above in order that it may obtain food and air. It sometimes shoots jets of water a foot or more above the surface of the mud whenever an intruder invades the flats.

The life along the shore constitutes a natural resource. The more the citizens of the state know about the individual inhabitants, the better use can be made of this resource and better attention can be given to its preservation. This new book is a worthy contribution to science and to conservation.—H. C. Bryant.

STATE BIRD TO BE SELECTED.

The California Audubon Society is sponsoring a move to secure a poll of the state as to a choice of a state bird. Children in the schools will enjoy making recommendations as will many bird lovers. In making choice, some decision must be made as to whether the requirement is for a bird well known to all or whether one of the more unusual and distinctive birds of the state may well be a candidate. The great California condor, the largest of land birds in North America, is restricted to this state and might well be chosen because of its size and its historical background. The valley quail is, of course, a contestant for honors and probably would be the choice of most sportsmen. Although less well known the wren-tit, a typical bird of the chaparral and to be heard in every patch of brush in the foothills, is a distinctive species found in the southwestern United States and the only bird in a family. No close relatives of this bird are known. Likewise, the yellow-billed magpie, found only in the state of California, receives consideration from the standpoint of beauty and uniqueness. If any reader is interested in this contest, he should send his

choice to the California Audubon Society, Los Angeles.

GAME RESTORATION PROGRAM INAUGURATED.

After hearing so much of such phrases as game depletion, game decimation and game disappearance, the term game restoration is refreshing. The *National Sportsmen's Magazine* has taken up this slogan and is doing its utmost to stir interest in putting back into game covers what is taken out by hunters. Emphasis is placed on game propagation as one method of bringing about better hunting conditions. The day has passed where a sportsman can consider his responsibility ended after he has paid the state license fee. His two-dollar payment certainly would not replace one deer nor the twenty-five ducks which he shoots. Hunting and fishing is worth more to a sportsman than he is paying for it, but he must assume responsibility in a restoration program.

REFLOODING OF LOWER KLAMATH LAKE HELD IMPRACTICABLE.

It has long been the hope of conservationists that some arrangement might be made by which a program could be undertaken for reflooding Lower Klamath Lake, which was at one time a splendid waterfowl breeding and feeding ground, lying partly in southern Oregon and partly in northern California. By reason of the use of the water of Klamath River in recent years for irrigation of agricultural lands and also for power, water has been lacking to keep the marshes of Lower Klamath Lake habitable for waterfowl.

A study was made this year by L. T. Jessup, an irrigation engineer assigned by the Bureau of Public Roads to the Biological Survey of the United States Department of Agriculture, to determine the practicability of a reflooding program. At a conference held in Klamath Falls, Oregon, on September 27 and 28, by Paul G. Redington, chief of the Biological Survey, with representatives of the California and Oregon game commissions, the report of the engineer was rendered. The many obstacles that preclude further consideration of the project were there brought out.

In the first place, the full supply of water from the Klamath River is needed for existing and projected irrigation plans and for power use. In the second place, legislation of the states of Oregon and California, which ceded the lands involved to the federal government for use as a reclamation project, stipulated that the

water should be used for irrigation purposes. In the third place, even if water were available, it is held that the reflooding of Lower Klamath Lake would be detrimental to agriculture in the immediate region, and the cost of necessary project works, such as dikes and pumping plants, and the purchase of privately owned lands, would run into a very large figure.

At the conference held in Klamath Falls it was decided to drop consideration of the reflooding program in the Lower Klamath region and to concentrate the efforts of sportsmen and others interested throughout the country on the restoration work to be done on the Bear River marshes, at the northern end of Great Salt Lake, in Utah. Here it is possible by diking to establish large areas of fresh water, which when completed will not only furnish breeding and feeding grounds for a very large number of waterfowl but will operate to decrease the mortality that has been so serious among the birds for many years.

The chief of the Biological Survey, in commenting on this general situation, stated that the news of the abandonment of the Lower Klamath Lake project would be disappointing to many sportsmen and conservationists of the country who had banked on the reestablishment of an important waterfowl concentration area there. Continuing, Mr. Redington said, "I am very sorry to be the harbinger of this bad news, since I am well aware of the great interest displayed by thousands of sportsmen and bird lovers in the project, but the obstacles to reflooding Lower Klamath Lake appear to be of an insuperable nature. Copies of the engineer's report on the project are to be given to many of the organizations that have been behind this project, and it is my opinion that after reading the report their judgment as to the unfeasibility of the project will coincide with the judgment of the Oregon and California fish and game commissions and with that of the Biological Survey.

"We are daily expecting the report of our engineer who has been working for the past few months on a plan to construct additional dikes on the Bear River marshes in Utah. We know that this sort of restoration work is entirely possible since the State Fish and Game Commissioner of Utah, Mr. Madsen, and certain duck clubs owning land on the Bear River marshes have already by diking established such areas.

"The state of Utah has, by legislation, consented to the establishment of a federal project, which, when completed, will comprehend more than 100 square miles of fresh-water marshland territory for

wild fowl, and it is our hope that this project may be consummated in the near future. Valuable not alone as a breeding ground but for feeding and resting, it is as important a concentration area as any that can be found throughout the United States, and it is imperative that action be had to remedy the conditions that for the past decade or so have caused such a heavy mortality of the ducks and other waterfowl in the lines of the great western migration."

Mr. Redington further stated that the engineering examinations of the Bear River marshes in Utah and the Lower Klamath and Malheur lakes in California and Oregon would not have been possible but for the generosity of western sportsmen, who raised a fund of more than \$6,000, which permitted the Biological Survey to obtain the services of competent engineers.

DISTEMPER ON FOX FARMS TO RECEIVE CAREFUL STUDY.

The University of Minnesota Medical School is engaging in cooperative studies with the Federal Bureau of Biological Survey of the cause and treatment of fox distemper, according to an announcement of the United States Department of Agriculture. Cooperators of the University are aiding the movement financially, and assistance by the Biological Survey also has been made possible by a slight increase in the federal appropriations made for the purpose by the last congress.

Fur farmers throughout the country and in Canada are bending every effort to prevent contagious diseases of their foxes, and the cooperation of research workers of the university and the Biological Survey will be welcomed by all fur producers. Studies of outbreaks of disease have been made by research workers of the two organizations, and as rapidly as possible the results will be made available to fox farmers.

Dr. J. E. Shillinger of the Biological Survey, formerly of the Bureau of Animal Industry, is in charge of the federal work, and Dr. Robert G. Green of the Department of Bacteriology and Immunology of the Medical School, represents the University of Minnesota.

So far as the resources of the Biological Survey permit, representatives of that bureau will cooperate with fox farmers in efforts to maintain the health of their stock. Outbreaks of disease on fox farms, if reported to Paul G. Redington, chief, Bureau of Biological Survey, Washington, D. C., will receive as careful attention as the funds for the purpose warrant. Material for laboratory study will be thus obtained, and research work will

be conducted to determine, when possible, the cause of the disease and remedial measures.

BEAVER FARMING IN CUT-OVER LANDS PROMISES PROFIT AND INTERESTING WORK.

In a report on the possibility of raising beavers profitably, the Biological Survey of the United States Department of Agriculture says that there are many localities where these fur bearers could be re-introduced without harm and where, through storing water in the reservoirs along mountain streams, they would do much good by helping prevent floods and extensive erosion, by increasing the stream flow in dry weather, and by improving the fishing resources of streams and lakes. In such places they would not only enrich forests and parks with a unique and intensely interesting form of wild life, but also would add much to the decreasing supply of valuable fur.

Beavers, the Survey has found, can be kept readily in a fully controlled if not a fully domesticated state. Because the animals are comparatively clumsy and slow walkers, they rarely go more than twenty or thirty rods from their home stream. To confine them to a narrow strip along a certain stream, therefore, it is only necessary to fence across the stream a short distance above and below their colony, running the fences at right angles to the stream about thirty rods on each side.

The best location for beaver farms is believed to be in the tier of states along the Canadian border. A rough guide to desirable range for beavers is the presence of the aspen or poplar tree. These trees are their favorite food and are of little value commercially. Much of the best beaver country is in localities where, after the original timber has been lumbered off and the ground burned over, thickets of aspen and pin cherry have sprung up as second growth. Such land is generally considered almost worthless, but it might support a large beaver population and could be successfully handled either on a large or a small scale. A small fur farm, where detailed attention can be given to the animals, is likely to prove more successful at first, and can be extended when management practices are fully mastered.

Anyone interested in the possibilities of beaver farming may obtain a booklet giving much additional information by writing to the United States Department of Agriculture at Washington, D. C., asking for Technical Bulletin No. 21-T.

BIOLOGICAL SURVEY SEEKS COOPERATION OF HUNTING CLUBS.

An effort is being made to enlist the cooperation of wild-fowl hunting clubs throughout the United States and Canada in reporting to the Biological Survey of the United States Department of Agriculture their bags of wild ducks and other migratory game birds taken during the 1927-28 open season. This information is desired as a basis, in part, for determining whether migratory game birds generally are increasing or decreasing. It will be of value in formulating regulations for their protection.

Paul G. Redington, chief of the Biological Survey, states that "this cooperation from the sportsmen and sportsmen's clubs of this country and Canada will be of great benefit not only to the birds but to the sport as well." Clubs and individuals interested are requested to communicate with the Biological Survey, Washington, D. C.; instructions and forms will be furnished. The work will be started early in October.

WATERFOWL SHOOTING PERMITTED ON PARTS OF UPPER MISSISSIPPI.

Under a recent order of the Secretary of Agriculture, waterfowl shooting is permitted during the present hunting season on parts of the Upper Mississippi River Wild Life and Fish Refuge, in accordance with the provisions of the Migratory Bird Treaty Act and the regulations thereunder, with state laws, and with regulations governing the use of the refuge.

The order permits hunting over navigable waters and meandered lakes only. Thus it has the effect of preventing shooting on marshlands and ponds, and on these areas waterfowl will have sanctuary. This reservation was authorized by congress chiefly to provide a refuge for wild life, but at the same time to afford a place that the public might enjoy for hunting and other recreational purposes, so far as consistent with the main objects for which the reservation was made. Hunting on private lands within the limits of the refuge is not affected by the order. It relates to waterfowl shooting only and does not permit the taking of other wild life on the reservation.

FORESTS PLAY IMPORTANT ROLE IN REGULATION OF STREAMFLOW.

That the forest plays an important part in the regulation of streamflow has been brought out by scientific investigation over a great many years and in many parts of the world, according to Raphael

Zon, director of the Lake States Forest Experiment Station of the Forest Service, United States Department of Agriculture.

The forests are not only an important factor in regulating streamflow, but also aid in modifying climate and the character of the soil, tending toward the improvement of the water storage capacity of any watershed. These conclusions of Doctor Zon's regarding the relationship of forests and floods are of particular interest just now when ways and means of preventing floods and regulating flood waters are being given such wide consideration. In his booklet entitled "Forests and Water in the Light of Scientific Investigation," just republished by the United States Department of Agriculture, he points out that although floods which are produced by exceptional rainfall can not be prevented by forests, yet, without the mitigating influence of the forests, floods are more severe and destructive.

"A national policy," he says, "which, though considering the direct value of forests as a source of timber, fails to take full account also of their influence upon erosion, the flow of streams, and climate, may easily endanger the well-being of the whole people."

The tendency of the forest is to equalize the flow throughout the year of all streams having their origin in tree-covered mountain regions. This is explained in an interesting discussion of the combined effects of the forests upon air and soil temperature, relative humidity, effective precipitation, evaporation, wind, physical character of the soil, and run-off of water, which, in turn, control streamflow. A comparison of many streams having forested and nonforested watersheds supports the conclusions reached by the study of contributing factors.

The booklet shows the effect of forest cover to be most beneficial on steep slopes, at the higher elevations and on nonporous soils. The forest breaks the force of storms, absorbs some of the water, permits still more water to seep down into the soil where it is gradually released to feed the springs and larger streams. The maintenance of a forest cover is shown to be the cheapest and best way of preventing erosion by its tendency to bind the soil in place.

A limited number of free copies of "Forests and Water" are available upon application to the Office of Information,

Department of Agriculture, Washington, D. C.

GAME ANIMALS KILLED IN FOREST EVEN BY SLOW GROUND FIRES.

Like the exile who brought about his undoing by yielding to the desire to return once more to his old home, the instinct of wild game to drift back to their range following a forest fire often leads to their destruction, according to evidence gathered by foresters of the United States Department of Agriculture.

While a forest fire, unless it is "crowning," or traveling in the tree tops, ordinarily does not travel fast enough to overtake the fleeing game birds and animals, the homing instinct is said to bring them back to their haunts frequently before a fire has subsided.

Commenting on the destruction of wild life by forest fires, J. W. Humphrey of the Forest Service, describes some of his observations during the Lost Johnny Creek fire in the Flathead National Forest in Montana last summer. This fire occurred in a mixed stand of spruce, fir, larch and white pine.

"The fire while at its height," Mr. Humphrey says, "did not travel faster than two miles an hour. This being the case, it would seem unlikely that deer or game birds would be overtaken by the flames. Pine squirrels and other animals, however, were all destroyed in the path of the fire. Along the edge of the fire, where we were trenching, we saw a number of pine squirrels that apparently had their feet so badly burned they could not climb trees.

"I found two whitetail deer on the creek below the fire fighters' camp that were burned to a crisp. Two others—one a large buck and the other a yearling—died near the Riverside pasture gate. Another old buck, with the hair over his hind quarters badly singed, and his feet so badly burned that he could hardly walk, was seen by the entire crew a number of times between Riverside and Murray Creek. I also saw a fawn in the vicinity of Spring Meadows that had evidently lost its mother. The feet of this fawn had been badly burned. However, it appeared as if it would recover. We found a great many grouse that had died from the effects of the fire.

"This fire did not travel fast enough to overtake either the game or the birds. It is my opinion that both, after the fire had quieted down, drifted back to their old range through the smoldering ashes. After getting in where the ashes were extremely hot, and burning their feet, they had become bewildered, and probably had run on until so badly burned that, even though they got out of the fire, they later died. Both deer and grouse appeared very reluctant to move away from their home range and returned before the ground had had time to cool. Nearly every day we would see deer wandering through the burn, especially on the meadows, even though the forage was practically all destroyed."

STUDY MADE OF MAGPIE IN RELATION TO AGRICULTURE.

The common magpie, a characteristic bird of the plains and mountains of the west, exerts an economic influence similar to that of the crow of the east. A study of its food habits, the results of which have just been published by the United States Department of Agriculture in Technical Bulletin 24-T, "The Magpie in Relation to Agriculture," by E. R. Kalmbach, biologist of the Biological Survey, indicates that as an insect eater the magpie surpasses the crow and all other members of the Corvine family, which includes jays, crows and magpies. Destructive weevils, caterpillars and grasshoppers characterize its insect food, which forms nearly 36 per cent of the bird's annual diet. The magpie also eats a limited number of small rodents, and as a carrion feeder it does additional good.

On the other hand, the magpie has some outstanding faults. It is guilty of the destruction of poultry and beneficial wild birds and their eggs and at times becomes a pest on the cattle ranch by its attacks on sick, injured or weak live stock. There are times when these birds become so bold or gather in such great numbers that a reduction in their numbers is warranted. Poisoning during the winter has been found to be an economical, effective and safe method of accomplishing this. Extirpation of the bird, however, is not called for, and before local campaigns of control are inaugurated careful consideration should be given to their necessity and scope.

Copies of the new bulletin may be had upon request addressed to the United States Department of Agriculture, Washington, D. C.

ANNUAL FUR LAW SUMMARY ISSUED.

To encourage effective action on the

part of those concerned in maintaining the supply of fur animals, including trappers, fur tradesmen, administrative officials, legislative committees and conservation societies, the Biological Survey issues a summary of the fur laws for each season. The thirteenth annual summary, entitled "Fur Laws for the Season 1927-28," and known as Farmers' Bulletin No. 1552-F, has just been published by the United States Department of Agriculture.

The authors of the bulletin state that the fur resources of the country are steadily diminishing and that the factors responsible for this are out-of-season trapping, overtrapping, a general tendency in many sections to class fur bearers as vermin to be killed on sight, a great reduction of fur-producing areas, unwise drainage of swamps and marshes, and needless destruction of forests and cover. The raw-fur catch during 1925-26 was approximately 20 per cent less than in the previous year, and the decrease for 1926-27 was even greater. The primary responsibility for making and enforcing laws to protect fur animals rests with the individual states, and the states are more and more appreciating this fact, as well as the fact that if they do not make and enforce appropriate fur-conservation laws, the public and private benefits from the fur resources will diminish to the vanishing point in the not distant future.

The new bulletin gives a complete summary in synopsis form of all the laws of the various states relating to fur animals effective for the present trapping season, also those of Canada, Newfoundland and Mexico. Regulations affecting interstate shipment of pelts are explained, and the fur legislation enacted during the year is reviewed, with all important changes noted. Copies of the bulletin may be obtained from the United States Department of Agriculture, Washington, D. C.

COMMISSION ACTIVITIES.

A number of important administrative changes have been made by the new Board of Commissioners since their appointment on September 2. They are as follows:

J. S. Hunter from chief of patrol to assistant to the executive officer. New duties will include game census and technical advice.

Mrs. Pearl Ford from assistant to the executive officer to secretary to the Board of Fish and Game Commissioners.

K. P. Allred from captain, San Luis Obispo district, to acting chief of patrol.

J. D. Dondero from deputy to captain in charge of the district to include Lake, Napa and Mendocino counties.

La Rue Chappell from deputy to captain in charge of portion of southern California territory.

W. B. Sellmer, captain Marin County, additional charge of launch patrol.

New badges have been issued to the

volunteer deputies to replace the many different styles and patterns. The new badge is a bronze shield and somewhat resembles that of the federal game warden. It assures uniformity and an equal dignity throughout the volunteer forces. The assortment of glittering oddities that formerly posed as badges has been called in and those privately owned will no longer be honored as marks of authority.

The comments on stream and field and game conditions made in the reports of the volunteer deputies are proving of interest and value to the division. They indicate not alone the coordinative work of the volunteer force with the regular patrol, but also indicate a more favorable attitude of the public toward the value of wild life and the need of its proper protection.

Up to November 1, sixty-seven organizations that have for their object the conservation of fish and game had recommended and sponsored the appointment of 269 volunteer deputies. These appointments have been made by the division.

Replies have come in from practically every employee of the division, giving the data requested on the personnel questionnaire sent out in July. A vast amount of useful information can be found in these papers disclosing ambitions and capabilities, as well as desires to become more proficient in each respective field of endeavor. It is planned to have these data serve not only as a personnel record but as a means of adapting those better fitted to perform other lines of work, and as a means of making adequate advancements.

The survey crew posting the boundaries of California's thirty-four game refuges was recently loaned a one-ton truck used at the Yosemite Hatchery. This additional equipment will serve to carry the crew from one refuge to another and will expedite the work.

Game refuges 1-H, Plumas County, 1-I, Placer County, 1-O, El Dorado County, 3-F, Contra Costa County, 3-G, San Mateo and Santa Clara counties, have been surveyed and posted. The crew is now chaining and posting refuges 3-A, Santa Cruz County, and 3-E, Santa Clara County.

Department of Patrol.

Much of the routine of the patrol office has been reorganized and adjusted.

Captains in all districts have been placed in complete authority and are now held accountable for conditions obtaining there. Except in cases of unavoidable emergency, deputies are instructed to act through their captains.

On October 11, a conference of the captains of patrol was held in San Francisco. Both land and water forces convened for the purpose of arriving at a common understanding of certain problems which were discussed in open meeting. The success of the conference has merited the suggestion that similar gatherings be held every three months.

The most clever schemes of men oftentimes are of no avail. This proved the case of two dove hunters in the Monterey district who, on killing over the limit of doves, thought themselves achieving the pinnacle of adroitness by concealing 26 doves in their bed-roll. Deputy Richard Young became suspicious of their character, however, and succeeded in taking them before Judge F. J. Voll of Hollister, who imposed a fine on each of \$75.

Due to the skill of deputies C. J. Walters and E. S. Hurlbut a catch of 190 trout was discovered in a snowbank near Lake Ellery in Mono County. An arrest of a near-by camper followed and Judge A. E. Rule of Mono Lake fined the "trout hog" \$100.

Even the ranks of the game wardens in California have been invaded by the fair sex. The division recently appointed Mrs. Walter B. Sellmer a volunteer deputy and her first case involved the arrest of an individual shooting from a motor driven conveyance.

A record plant of 100 cans of trout fry was made by Captain J. E. Newsome's division on October 28. Just two hours and five minutes were allotted to the men to plant 20 miles of the Merced River from the terminus of the railroad at El Portal to the upper end of Yosemite Valley. Three trucks met the fish car at El Portal at 11.45 a.m. and returned the empty cans before the departure of the train at 1.50 p.m. One truck planted the stream as far as the power house, a second, the river above the Pohono bridge and a third from the Sentinel bridge up stream. The water was at a satisfactory temperature, there was little loss in fish and those planted were in fine condition.

An enviable record of arrests and con-

victions dealing with deer cases was attained by deputies Walter Emerick and R. E. Bedwell. They secured eleven convictions during the opening of the deer season in district 3. The fines imposed on the defendants convicted totaled nearly \$1,000. Later in the season, Deputy Emerick made a case involving the killing of a fawn, which resulted in a \$200 fine.

"This should serve notice on all violators of the fish and game laws, that those who come before me will be severely dealt with in the future. The wild life of California is one of the state's greatest assets and I am heartily in sympathy with the rigid enforcement of the laws existing for its protection." With this declaration, Police Judge Daniel O'Brien of San Francisco sentenced John J. Ryan to serve thirty days in jail for having more than 100 wild ducks in his possession during the closed season when he was arrested on August 25. It is claimed that Ryan has been a violator for twenty years.

Profits on the sale of 102 pounds of striped bass were trimmed down as a result of the assessing of a fine against A. Romeo, fish dealer, by Judge Lyle T. Jacks, in a San Francisco police court.

The fish had been delivered to a prominent San Francisco hotel and were about to be served when Deputy Earl Caldwell seized them. Two employes of the hotel declared Romeo had been ordered to bring sea bass, but brought striped bass instead. The offender admitted in court that he had been arrested four times for illegal handling of striped bass. He was warmly scored for his disregard of the law and sentenced to pay a fine of \$250.

The bass were turned over to the Shriners Hospital. Here they were served to the youngsters who were patients in the hospital.

On January 7, 1925, Deputy Walter Sellmer seized a truck loaded with 180 dozen crabs at Sausalito as the driver was about to cross on the ferry to San Francisco. Suit was brought in the name of the Commission for illegal transportation and the crabs were retained on the ground that they had been brought from Humboldt County.

The decision of Superior Judge Edward Butler of Marin County rendered on October 20, 1927, is worthy of more than the brief notice space permits here, for he impressed on the offender that dealers in products of the sea must comply with the laws and rules laid down for the

purpose of conserving and protecting the inhabitants of the deep.

A fine of \$1,000 was meted out with an alternative of one year in jail in the case of Chester Chambers of Colusa on November 13, by Judge John M. Golden of San Francisco. The offender was apprehended with 100 ducks in his possession and charged with two infractions of the law: the possession of ducks during the closed season and possession of more than the limit. The maximum fine was imposed on each count.

It has been suspected that market hunters have been killing ducks by the hundreds and bootlegging them in the larger cities. Judge Golden is deserving of the praise of all those who appreciate the value of checking the ravages of the market hunter. It is only through the coordination of the courts with the work of the wardens that illegal hunting can be pared down.

In commenting on the case, District Attorney Matthew T. Brady said: "With hunters and anglers increasing every year and our fish and game diminishing, we must do everything in our power to protect the remaining supply if the coming generations are to have fish in our streams and game in our fields."

Peter Balestreri, well known San Francisco fisherman and consistent violator, was found guilty of illegally having striped bass in his possession early in November by Judge Lyle T. Jacks and sentenced to pay a fine of \$250 and spend five days in the county jail. It was Balestreri's third offense in one year.

The violator was apprehended by Deputies C. L. Bundock and Earl Caldwell on the morning of October 20 after he had been pursued for many blocks in the early morning. In attempting to elude capture the fisherman tossed out of his speeding machine the two sacks of striped bass and finally in desperation abandoned his car, with the motor running, in the middle of the vacant street. He was positively identified, however, by both deputies before the gloom of the morning concealed him.

Lest the educational campaign directed against the practice of "piecing out the bag limit" has failed to remedy conditions, deputies of the Division of Fish and Game have concentrated their attention on gun clubs. It will take gun clubs in California a long time to live down their reputation of being hoggish in the matter of exceeding the bag limit. Certainly if action does not come within the

organization, the Division of Fish and Game will see to it that the law is enforced. Gun clubs have no special privileges and if they do not enjoy having deputies search members as they leave the club, reform is necessary.

The deputies patrolling the duck haunts in northern California have established a camp near Maxwell. A building of a rice grower has been fitted to serve as a dormitory and assurance thus made that deputies exposed to a night of mud and rain while watching for the flash of a pot hunter's automatic will have a warm shelter and a dry bed. Further consideration for their health and comfort has been manifested in the employing of a cook, who, it is said, serves excellent meals.

The reports from the Los Banos and San Joaquin delta districts are very encouraging and market hunters are well aware that deputies are in the vicinity. So far little trouble has been experienced with violations on the part of free lances. About the only irritation with the commercial clubs has been the tendency of the duck clubs to oversell their blinds, and in nearly all cases of the sale of ducks, the sale has been made in the duck fields to hunters who failed to bag a limit of ducks and desired not to lose favor among those to whom they had boasted at home.

It was estimated that there were 3000 duck hunters in Imperial Valley on the opening day of the duck season. Every hotel from Westmoreland to Mexicali was full and hundreds of hunters were camped along the roadside.

At the first break of day it sounded like Chinese New Year. After one hour of shooting the ducks were up in the air so high they looked like small black-birds and were all headed for Mexico, never to return.

Deputy E. D. Ricketts writes: "Deputies W. S. Talbott, R. J. Little and myself estimated that there were 250 limits of ducks killed on the opening day. These included sprig, cinnamon teal, green-wing teal and Fulvous tree-duck, a Mexican duck that very seldom goes north of the Salton Sea. There were very few geese.

"The duck area of the Salton Sea ranges from 150 feet to 250 feet below sea level and in this area there are some forty-odd commercial duck clubs and private clubs that have most all the land along the sea from Mullet Island to Mecca, in Riverside County. The charge to hunt on the commercial clubs is from one to

five dollars per day. It devolves upon the hunter to try and get a duck if he can. When a duck comes along everyone starts to shoot and if a duck is killed everyone runs for it, then the fight starts to see who gets it.

"There are also thousands of shore birds in the rice fields and along the sea. Several hundred curlew and a few jack-snipe were seen in the rice and barley fields.

"Six cases were made the first two days of the open season for shooting shore birds and four duck cases were made the night before the opening for shooting ducks in closed season.

"The ducks feed mostly at night in the Imperial Valley and return to the Salton Sea at daylight, to rest. The Salton Sea is quite a large body of water some 40 miles long and from five to seventeen miles wide. There are two rivers running into the sea, the New River and the Alamo. Most of the ducks loaf at the mouth of these streams where fresh water comes in, as the water in the Salton Sea is very salty, and these points are where the most of the motor boat shooting has been going on.

"The division had no motor boat patrol on the Salton Sea until this year and all the deputies could do was to stand on the shore and look on, but with the patrol boat, *Ibis*, which is being launched at Mecca, the deputies will be able to put a stop to the motor boat shooting on the sea."

Over nineteen millions of trout fry were planted under the supervision of the deputies this season. The reports are uniform in their showing that the fish were planted with entire success. In all cases of apparent inefficiency, further investigations disclosed that the negligence was unavoidable. In a few instances deputies were ill or called away unexpectedly to take care of unforeseen cases that required their immediate attention. On the whole the loss of fish was slight.

The planting went forward very rapidly during August and September and then slackened considerably as the hatcheries were emptied. By the middle of October there were but three carloads to be sent out from the Mount Shasta Hatchery and nine from the Mount Whitney Hatchery. These late shipments were to regions in the coast range where there was little danger of the planting crews being caught by snow. The last fry shipped from the Whitney Hatchery were large, and, though more cans were required to transport them, their good size

and fitness assured better chances of survival.

A study is being made by supervising captain O. P. Brownlow involving plans for the coming year and the mapping out of a definite program.

The success of the new planting truck suggests a way out of many difficulties so common in the past. If trucks could be extensively used throughout the state to convey the fry to the streams, a decided improvement would result over the present system. Captains of districts could go to the hatchery foreman and learn when their allotment would be made and then make plans accordingly so as to serve better the interests of their respective districts. This plan would avoid last minute notices and work under conditions hastily planned and often very arduous because of lack of adequate preparation.

If three pack trains of eight mules each could be placed in the fields with three men working on each train and each train working out from bases at concentrated points, distribution could be made in the less accessible areas and in places not reached by trucks. The pack trains could also transport fish caught by hook and line to barren waters in the vicinity. It is suggested that the first distributing bases for pack outfits be so located as to cover eastern Fresno and Madera counties, Mono County and El Dorado and Placer counties.

A new location was selected for the holding pond near Cloverdale on the Russian River to afford a better test of its feasibility. The pond selected last year to try out the benefits and detriments of holding ponds in general proved unsatisfactory. The present location is shaded and the water diverted from the river constantly cooled by seepage.

Squaw fish and hardheads are abundant in the Russian River, as well as black bass. These fishes have a great preference for trout fry and are very destructive. It is hoped to hold the trout placed in the pond near Cloverdale until they reach a size capable of holding their own against these natural enemies.

Captain J. D. Dondero has performed some very creditable work rescuing stranded fish in tributary streams of the Eel River. He estimates that he has placed some 80,000 fish in good water.

Rescue work involving the saving of many thousands of bass, crappie, perch and catfish has also been in progress in the San Joaquin Valley south of Newman under the direction of Captain J. E.

Newsome, and in Tulare County supervised by Captain E. W. Smalley.

Captain Walter Sellmer on November 15 seized 12,090 feet of illegal nets being used by fishermen in District 2 in the mud flats between Mare Island and Sonoma Creek. These nets, nearly two miles in length, were being used in an unlawful way to block off an area in territory closed to fishing.

On November 3, George Baird forwarded by parcel post an apparently innocent looking package marked "bulbs and plants" from Shasta County to a party in Ross, Marin County. The Horticultural Commissioner at Ross opened the package with an eye to discover any possible introduction of plant diseases. To his amazement there were five mountain quail. They were turned over to Captain Sellmer who is now prosecuting the case for concealed shipment of quail shot out of season.

Department of Fish Culture.

The 2,350,000 quinnat salmon held in ponds at the Mount Shasta Hatchery were liberated into the Sacramento River around November 15.

Distribution of trout throughout the state was made by both cars No. 01 and No. 02 until September 14, when car No. 01 was transferred to the Mount Whitney Hatchery. The last trip of the distribution car was made from the Mount Whitney Hatchery on November 9, over 2,000,000 trout being distributed from this hatchery for the season. Up to November 1, a total of 10,636,500 trout had been distributed from the Mount Shasta Hatchery.

Spawning has been late this year and but 317,000 Loch Lave, 90,000 eastern brook and 114,000 brown trout eggs have been secured. Six hundred ninety thousand quinnat salmon eggs have reached the Mount Shasta Hatchery from the Klamathon station. The trout in the ponds are looking well and it is believed that a yield equal to that of previous years will be forthcoming from the pond fish.

The repair work of the auxiliary stations of Camp Creek, Bogus Creek, Beaver Creek, Shackelford Creek and Hornbrook Creek has been completed. These stations are now ready for the operations of the egg collecting crews.

From the Gull Lake egg collecting sta-

tion 900,000 eastern brook trout eggs were received at the Mount Whitney Hatchery on November 19. This station was forced to close and the crews to abandon their work due to the cold and storms. The snow was so deep the crew had difficulty in making their way out. The excessive fishing in June and Gull lakes will soon materially reduce the number of eggs that can be collected unless conditions take a turn for the better.

The Domingo Springs and Clear Creek hatcheries have been closed and repairs

to Blackwood Creek where it will be set up. The Taylor Creek racks have been reinforced and the seining quarters shingled.

Four large retaining tanks have been constructed at the Yosemite Hatchery. These are to be used for the purpose of holding trout fry until they reach a certain size, which, it is believed, will insure a greater percentage of survival. They will also increase the capacity of the hatchery and enable certain hatcheries to serve full time. The Department of



FIG. 30. A catch of golden trout from Rock Creek near Lone Pine, California. Through fish distribution, streams containing golden trout are now accessible to all. Photograph by Burton Frasher.

made. The Warner Creek trap is ready for installation as well as the Butt Creek trap. If snow does not fall too deep, it is planned to build more troughs and tanks to increase the capacity of these hatcheries.

The superintendent's and employees' cottages at the Tahoe Hatchery have been completed and furnished and are now occupied. Repairs are being made on the hatchery building. The Ward Creek trap has been dismantled and transported

Architecture is constructing a superintendent's cottage and another for his assistants.

Plans have been perfected for the establishment of an aquarium in a room adjoining the Yosemite Hatchery. The aquarium tanks will be in readiness by the coming tourist season. The hatchery is so admirably serving in an educational way that this additional feature will materially aid in conveying to those who visit the hatchery a more delightful impression of fish cultural work.

The Prairie Creek egg collecting station is about complete. This station, it is hoped, will furnish at least half the supply needed for the Fort Seward Hatchery. It was established after considerable investigation. The racks were located so as to take advantage of the run of both salmon and steelhead up Lost Man Creek and Prairie Creek.

Another experimental station will be located on Mill Creek, one of the main tributaries of the Smith River in Del Norte County. A tent hatchery will be set up and a trap installed, the station being ready for operation by the beginning of the steelhead run.

Still a third station has been selected on Mormon Creek four and one-half miles from Sonora. A tent hatchery will be in place containing thirty troughs. If the site proves suitable for hatchery purposes a permanent hatchery will be built to supply the fish for Tuolumne County, and, possibly, Calaveras County.

The Kern River station, a fourth experimental station, will be in readiness before the end of the year. Living quarters for the attendants have been built and the troughs are on their way to be installed in the tent hatchery.

Thirty-five years ago an agreement was entered into between the states of Nevada and California for joint operations on Marlette Lake. This practice had to be discontinued some years due to the shortage of fish. Happily, there were enough fish in the lake to justify a division of the eggs this season. Marlette Lake is situated at an altitude of 8000 feet and supplies from a million to a million and a half eastern brook trout eggs when weather conditions are favorable. The early fall of the year just past was unfortunate in this regard and the Nevada Commission is not expecting to harvest the usual amount of eggs.

The foreman and his assistants are rushing construction and preparation of the troughs in order to get the new Burney Creek Hatchery in shape for the coming season's work. Eggs will be shipped from the Mount Shasta Hatchery as soon as possible and it is planned to have the hatchery raise enough fry to plant all of eastern Shasta and Modoc counties.

Traps will be installed in the spring in the creeks tributary to Lake Britton. It will require several years, however, to establish a good run of trout in the lake. The presence of large numbers of bass

in Lake Britton will probably prevent this.

A hatchery on Cold Creek in Mendocino County, is being constructed. This new hatchery will be located about eight miles from Ukiah and will replace the old hatchery at Ukiah which has been able to supply but one-quarter of the number of fry needed for the district. The Ukiah Hatchery, however, will not be abandoned until it is certain that the Cold Creek Hatchery will be completed in time to take advantage of the steelhead run.

An epidemic among chinook salmon broke out during the month of September. The biologist of the department, George A. Coleman, made a technical examination of conditions prevailing on the Klamath River at the time when the epidemic was at its height. These epidemics, while known to have occurred in the past, have not been made the object of any special study. Hence, this investigation was of particular value and interest.

Mr. Coleman also made investigations of the Yosemite Hatchery, Lake Eleanor, and of Prairie Creek. The latter two investigations were made for the purpose of determining the feasibility of establishing egg taking and egg eyeing stations.

Department of Commercial Fisheries.

Mr. H. B. Nidever, an employee of the Division of Fish and Game since June, 1908, has been put in complete control of the Commercial Fisheries Patrol of both northern and southern California. Centering responsibility should aid greatly in law enforcement. Mr. Nidever will stimulate better enforcement of the law protecting Pismo clams as well as enforcing laws relative to fish reduction. It is expected also that the complaint that the laws were better enforced in the southern part of the state than elsewhere will be obviated.

Three ships of the Scandinavian whaling fleet operated for some time during the fall in the vicinity of San Clemente Island. These ships were tied up by the United States marshal during October on account of debts owed a local ship chandler and because of noncompliance with the custom laws.

Captain Peterson, a local fisherman at San Pedro, has conceived the idea of

bringing Pismo clams from Turtle Bay, Mexico, to San Pedro in several ton lots and planting them on the nearby beach and selling them to the local markets as the trade demands. In starting this new industry, Captain Peterson has promised to comply with all laws which apply both here and in Mexico. Having obtained a supply at Turtle Bay, the success of the new venture is awaited with interest.

Mr. L. H. Kelly of the Hawaiian Division of Fish and Game has been visiting California with the purpose of securing various birds and fish for introduction into the Islands. Mr. Kelly plans to take several hundred Pismo clams and abalones to Hawaii and attempt their introduction. There have been several former attempts of this kind but they have met with failure because of the difficulty of shipment. Mr. Kelly has devised some specially designed crates which he believes will transport these shellfish satisfactorily.

During the barracuda season a research assistant of the State Fisheries Laboratory centered his attention on field work. Data as to the size measurements of the catch and observations of the spawning were gathered. Some very young fish were fortunately obtained during September. The question of age determination through the microscopic examination of scales is to be undertaken this spring.

This past fall a purse seine boat from San Pedro demonstrated that purse seines can catch sardines in steady quantity in Monterey Bay. However, since the lampara fishermen were delivering all the sardines the canneries could handle, both cannery and fishermen wished to cancel the contract with the purse seiner. This was finally accomplished by joining the forces of both cannery and fishermen.

The patrol boat *Albacore* has been overhauled and repaired and during November and December worked over the northern end of the district. Mr. Paul Bonnot continued his work of gathering knowledge as to the extent of damage caused by sea lions and additional data as to their life history and habits.

Bureau of Education.

In that the Division of Fish and Game is made responsible for the protection of song birds, it is only reasonable that depredations by such birds be investigated and help given the farmer. For

several years complaint has been growing relative to the destruction of grapes by birds in the Porterville district of Tulare County. During the early part of November, Mr. Donald McLean was detailed to find out how much damage was being done and which birds were responsible. He found that certain owners were hiring men to patrol the vineyards and shoot every small bird seen. Reason for such a procedure was shown in that late ripening grapes are packed in sawdust, and if one or two grapes are broken the whole keg is likely to spoil. Each bunch of grapes has to be trimmed of the bird-picked fruit. Some of the birds killed in vineyards were sent to the San Francisco office and a study made of the stomach contents. Some were found to be grape eaters, others were apparently innocent species bent upon the destruction of insects rather than the destruction of fruit. Like studies were made of the damage done by quail in vineyards in San Benito County.

Investigations of this sort will do much to gain the confidence of the public and at the same time will place bird protection on a sounder basis.

During November the exhibit, "A Forest Tragedy," was installed at two different expositions held in the Civic Auditorium, San Francisco. Thousands viewed the exhibit and commented upon the lesson it teaches. Literature on a nearby table was furnished those interested.

The complete collection of birds' skins and birds' eggs has been rearranged and catalogued. In addition, a fine set of new specimens has been added to the collection of bird skins. Celluloid containers are being manufactured and it will soon be possible to make loans of bird skins to teachers and to various organizations. Such containers are necessary in order to prevent deterioration of the specimens.

Special attention is now being given the lecture program in the rural schools as well as the city schools. The boy with a .22 rifle who shoots everything that flies is a well-known problem in every rural school. If these school lecturers can help develop the boys in our country districts into good sportsmen and conservationists and can at the same time develop respect for the game warden of the district, splendid fundamental work for conservation can be accomplished.

Bureau of Hydraulics.

The cooperation of oil companies in cleaning up their properties and in nipping the pollution problem in the bud, so to speak, is being secured through an earnest effort on the part of the bureau. The bad effects of pollution and its cure by effective methods is finally being heeded. There is no doubt that some of the latest examples of this cooperation will greatly increase the efficiency of the present program of protection for fish and plant life.

sump and the measures taken to prevent pollution.

A suit against sixty-seven oil operators in the Huntington Beach field was filed early in October in the superior court of Los Angeles County. This suit was in the form of an injunction sought to prevent the present polluting of the Pacific Ocean with petroleum now permitted to flow into lines of drainage by the respective defendants.

The suit comes as the result of an exhaustive investigation pursued by the bureau after an inspection of the field



FIG. 31. McGillavray Dam on Canyon Creek, Trinity County, showing the new fish ladder recently completed. October, 1927. Photograph by G. O. Laws.

An inspection of the Shell Oil Refinery at Martinez occasioned praise for the excellent work done by the company and in particular by G. H. Van Senden, manager of the refinery, for the fine results obtained in dredging the sumps, making a general cleanup and providing against possible leakage of oil in the future. At least \$20,000 was spent in carrying out the cleanup program and in precluding the possibility of further pollution.

Much satisfaction also resulted from the way in which the Oil Operators, Inc., at Long Beach, are maintaining their

early this summer. The inspection was extended to the premises of every offending operator of oil wells in the field and conditions were summed up to be very bad. Samples of oil were taken at the time of the survey and photographs of the drainage and the polluted area were made with a view to their use in a court action.

The suit will enjoin the offending companies from operating until such time as the areas in question are cleaned up and assurances made that the pollution will not occur again. The larger oil companies have always shown a willingness

to cooperate in the attempt of the Bureau to prevent and halt pollution, but the smaller independent operators have, so far, failed to see the light. It is hoped that the filing of a suit on a wholesale scale will stop these smaller companies from operating unless the pollution is stopped and that the steps taken will have the same effect that similar action had on a large number of companies in the Long Beach field last year.

A last minute report shows that the majority of the defendants named in this action are taking steps to clean up the polluted areas.

The Cain Irrigation Company in Mono County will install a fish ladder on Grant Lake and four fish screens on Rush Creek as the result of a court hearing held at Bridgeport in September. Efforts to effect an installation without the necessity of legal action were of no avail.

A fish ladder on Ralston Dam at French Meadows, Placer County, was inspected and found satisfactory. This ladder was installed last year in accordance with an agreement.

The Mendocino Lumber Company completed a fish ladder at Hellgate Dam on the South Fork of Big River in Mendocino County.

An agreement was reached with the Marin Sanitary District to install a fish ladder at a place where a sewer pipe crossed San Anselmo Creek in Marin County.

The Clover Valley Lumber Company in Loyalton, Sierra County, has cleaned its mill pond of bark, sawdust and other settled matter deleterious to fish life.

The State Board of Health after a hearing in Sacramento gave permission to the Sacramento Development Company to pass the effluent from a fifty-ton sulphide pulp mill and a 3300-pound rayon plant into the Sacramento River at Freeport. The attitude of the division in the matter was presented to the board at the time of the hearing. It is believed that the permit issued will safeguard plant and fish life inasmuch as it might be affected by the effluent.

The owners of the S. S. *Edna Christensen*, Sudden and Christensen, were brought into court and fined \$300. They

were found guilty of pumping oil in bilge water into the estuary at Oakland.

The Pan American Petroleum Company has been making experiments to ascertain the best way to prevent pollution. They are constructing cooling towers at the very considerable cost of \$125,000 at their Watson refinery that will cool and save about 80 per cent of the water, according to tests made.

The Union Oil Company at Oleum is engaged in enclosing and filling in an area along its shore line to mitigate the unsightliness of the many scattered oil drums and to prevent oil seepage into the San Francisco Bay waters. The bulwark is of planked piling and rock fill and will cost, together with dredging the old sumps, some \$85,000.

For twenty years the salmon and steelhead have been barred from Greenwood Creek, a fine spawning stream that empties into the Pacific near Elk in Mendocino County, but this year, due to the cooperation of the Goodyear Redwood Company with the Division of Fish and Game, the stream has been opened.

During this long span of years the stream had been blocked by a dam maintained by the lumber company to operate a pond for floating logs for milling purposes. After a series of conferences a fish ladder was devised for one end of the dam. While these negotiations were under way many difficulties cropped out and at one time it was thought that it would be necessary to tunnel through the rocky hill at the side of the dam for over one hundred feet, at an almost prohibitive cost. A ladder, however, was designed that solved the problem and the lumber company went to work on the job as soon as the plans were completed by the bureau.

Reports declare that fish are making use of the ladder and are having no difficulty in going through the jumps. The ladder is unique and the splendid cooperation of the lumber company with the Division shows that there are still commercial concerns that want to conserve fish.

Bureau of Game Farms.

During September 1709 ringneck pheasants were liberated. By far the larger number of these went to Santa Barbara and Imperial counties. The fol-

lowing month, 895 birds were planted: at Red Bluff, 100 birds; Pleasanton, 100; Orland, 125; Bakersfield, 150; Tulare, 150; Temecula, 120; and Crows Landing, 150. These birds made a wonderful showing. They were full grown and their color and beauty impressed spectators as they took to the air from the open coops.

The selection of the new farm in the southern part of the state has occasioned much investigation, for many factors enter therein. Water is one of the prime requisites governing the choice of location. Avoidance of fog is another as well

every day of the year and noted the whole cycle in the activities of the ringneck are now in a position to give valuable data. What is equally reassuring is the increased interest shown in the welfare of the introduced species in all these areas.

All the plantings of last year have been carefully checked and it has been found that the pheasant is doing as well in California as in Washington, Oregon and British Columbia. The state has much territory well adapted to upland game birds, furnishing cover and suitable food the year around. The greatest area suit-



FIG. 32. Superintendent Bade of Yountville Game Farm discovers stolen pheasant nest. July 17, 1927. Photograph by Sidney Snow.

as avoidance of heat from April to July.

Further construction work at the Game Farm has involved the erection of new breeding pens. These, due to their secluded location and quiet, will insure a higher quality of eggs. Care has been expended to place the birds as near to natural conditions as permissible.

All of the areas stocked last year have now been replanted. Useful and valuable information has been secured from farmers and those who have been in close touch with the progress made by the birds. Farmers who have been on the ground

able is in the great interior valley of California. Both the San Joaquin and Sacramento valleys are large enough to readily absorb the output of a single game farm.

With the recent rains the work of renovating and cleaning up the pens was commenced. All of the pens along the main alley way have been plowed and seeded. The domestic poultry house has been rearranged and a new cooking house built to accommodate two forty-five gallon caldrons.

Bureau of Research.

A number of major problems of game diseases have been carried to the point where the full time services of a qualified pathologist are necessary. Hence, a full time pathologist has been secured. The bureau will continue to have the cooperation and aid of the Hooper Foundation.

The tabulation and filing of over 19,000 deer tags in addition to license stubs and compilation of trapping data and case records has occasioned routine work for the department of very considerable magnitude.

The Director of the Bureau attended the Seventh Annual Convention of the Western Association of State Game Commissioners held in Seattle on September 8 and 9. The outstanding feature of this convention was the desire of the representatives to bring about a solution of the migratory waterfowl situation in the west.

As an aftermath of this meeting in Seattle, the division was cordially invited to be represented at a conference held at Klamath Falls. Here a progress report was heard on the feasibility of reflooding Lower Klamath Lake. The report presented the present obstacles in the way of establishing a suitable and adequate refuge for migratory birds and summed up a survey recently made by government engineers under the auspices of the United States Biological Survey.

R. J. Irvine made a series of tests in the use of thallium as a rodent poison. The experiments were made possible by the United States Biological Survey, whose agents operated recently on the property of the Moraga Land Company in Contra Costa County.

Thallium-salts will color the flame of

an alcohol lamp green. It was at first believed that this was a certain and convenient means of detecting the presence of the poison. After many tests, it was decided that the spectroscope, after all, was the most reliable and sure means of discovering whether the poison was present in either animal or bird.

The experiment was made to determine the effect of the poison on rodents at a time of year when food is scarce and to gain some notion of the amount of poisoned grains likely to be uneaten by rodents, and left to be picked up by birds.

The formula for the poison is twenty ounces of thallium sulphate to 125 pounds of potted barley. The thallium was mixed with starch and enough glycerine added to make a paste. This was placed in a copper drum and rotated until the barley was well coated with the poison. The poisoned grains were then placed in a leather bag, for wherever the poison comes into contact with the hair, it is said to cause it to fall out. The grain was scattered from a horse, the operator using a metal spoon.

The experiment showed that four men could poison 1000 acres in three days at a cost of around \$218.

There have been few serious recurrences of the duck disease epidemic. A slight outbreak flared up in the Tule Lake country, but an investigation proved not as alarming as at first reported. Another case of duck sickness was reported in Contra Costa County but this too was found to be not extensive. Further research on dead birds disclosed lead-poisoning and it is believed that death was occasioned by this cause rather than from sickness. Sixteen number six, chilled shot were fed to a well duck and eight to another duck. Both ducks died, revealing pathological conditions similar to the dead birds from the Contra Costa locality.

COMMERCIAL FISHERY NOTES.

N. B. SCOTFIELD, Editor.

SARDINE SCARCITY AT MONTEREY.

Beginning with the second week in October, eight weeks have passed during which practically no sardines have been caught at Monterey. During September, the catch was exceptionally heavy and the ten canneries at that place were running at capacity. This long absence of sardines is unprecedented and is causing a

great financial loss to the canners, the several thousand persons employed in the industry, and, in turn, to the whole Monterey community. The question arises in the minds of sardine canners and fishermen: Is this scarcity caused by overfishing, and has the supply been seriously depleted by present intensive fishing methods?

To detect depletion of our commercial fisheries is an important part of the work of the Department of Commercial Fisheries, and for seven years now, extensive data of the sardine catch at Monterey have been gathered and analyzed by members of the State Fisheries Laboratory staff.

There is no good evidence, as yet, that the fishing operations at Monterey are drawing too heavily on the sardine supply for safety of the future, or that any fluctuations in abundance are due to other than natural causes. It must be admitted, however, that a series of records extending over a period of seven years is hardly sufficient to show whether or not the fishing is too heavy, and we should be very cautious about any undue exploitation of the supply until the investigations have been carried to the point where we can be certain of detecting depletion before it has advanced beyond the danger point.

While there is no evidence that the fishing operations at Monterey are causing any noticeable diminution of the total sardine population from which the fishery draws its supply, there is evidence that the operations temporarily exhaust the local sardine population to such an extent that fishing operations cease until fresh sardine schools are brought into the bay by storms. The supply of sardines in Monterey Bay is soon exhausted by the tremendous daily catch of a thousand tons. There is a slowing down of the fishing, and finally it ceases and the industry is idle until a fresh sardine supply arrives.

Under these conditions, to take more sardines than can be put in cans, and run the surplus in the reduction plants, lengthens the time when there is an absence of local sardines and the canneries and the thousands of employees are idle. There is good reason to believe that if, during the time of sardine abundance in Monterey Bay during the first of the season, no sardines had been used in the reduction plants, the canneries could have continued to operate for a longer time. In the meantime, there are no sardines for the Monterey canneries and gloom hangs over the historic place—and those who seldom pray are now praying for a storm or a good stiff north wind to bring the sardines in.

Another thing has been noticed and spoken of by the canners, and that is that the period elapsing between the times of plentiful sardine supply is becoming increasingly longer; and it has been noticed that not always does a storm or

a favorable north wind bring the expected supply of sardines into the bay.

In the light of these facts, we should be careful with the supply when the getting is easy.—N. B. Scofield.

BOOTLEG BARRACUDA.

The barracuda is one of the most important fish in the southern district on account of its abundance, its good eating and shipping qualities. The catch of barracuda in the state, taking an average of fish received for the past seven years, amounts to 7,000,000 pounds annually, including about 2,500,000 pounds received from Mexican waters. Practically all of the barracuda is taken in southern waters. However, some years there is a fair catch in Monterey Bay.

During the flush of the season in May, June and July, the Department of Commercial Fisheries is actively engaged in overseeing the barracuda catch. This is necessary on account of the weight limit of three pounds imposed by law and the restricted methods of taking the fish. The numerous docks and landing places around San Pedro, Wilmington and Long Beach add another serious difficulty to the situation and it has been necessary to maintain a night and day patrol in order to stop the "bootleg" barracuda business.

The regularly established wholesale markets have, in most cases, realized that the game of violating the law in the aggregate does not pay. Accordingly, most of them have become fairly good conservators. All the wholesalers of the San Pedro district recently made what might be termed a "gentlemen's agreement" not to handle any unlawful barracuda. It was agreed that in any case where one found the other, or anyone else, handling small or purse-seined fish, they were to report the violation and assist so far as possible in prosecuting the offender.

Since the law prohibiting the use of purse seines and lampara nets for taking barracuda went into effect in 1925, the fish have been taken with gill nets and hook and line. The purse-seiner or lampara net fishermen still persist in making hauls and either transfer their load to a gill or hook-and-line boat at sea or try to smuggle it into the harbor and land it on some waiting truck or wagon at night.

An amendment to the net law which became effective July 29 again allows the use of purse seines and lampara nets for taking barracuda. It is still unlawful to use these nets during two and one-half months from May 15 to July 31. It is hoped this law will overcome the over-

catch condition which always accompanied spring fishing. The marketman's, as well as the fisherman's, business will be relieved of the oversupply, with the resultant low price which was formerly the case, when both the marketman and fisherman lost money.—H. B. Nidever.

DRAG-NET FISHING HAS DEPLETED HALIBUT SUPPLY.

A southern California paper quotes the skipper of a local fishing fleet to the effect that the high price of 18 cents per pound for halibut is chiefly caused by the depredations on halibut and nets by seals. This is in line with the tendency of commercial fishermen to explain the scarcity of fish by attributing the cause to anything rather than to overfishing. The high price of fish is caused by a scarcity of the fish, and the scarcity of southern California halibut is due to destructive methods of fishing in the past and to a condition of depletion at the present time. There is considerable doubt as to whether seals do any appreciable damage to halibut, but there is no doubt that the past destructive fishing of drag boats is the principal cause of the scarcity. Drag-net fishing has been prohibited south of Santa Barbara County for four years, and it remains to be seen if this great protection will cause halibut of that region to increase in numbers.

It should be remembered that not many years ago, before our fisheries began to be developed, there were many more seals than at the present time and the halibut were also very abundant. The seals and sea lions have been reduced almost to the point of extermination, and coincident with this halibut have become so scarce that they bring 18 cents a pound. The cause is clearly one of overfishing. The explanations of fishermen and fish dealers (and fish cannerymen, for that matter) for the scarcity of fish, whether it be salmon, sturgeon, tuna or halibut, are often weird and fantastic, and anything but the real reason—overfishing.

SOUTH AFRICA WANTS HERRING.

The Englishmen in South Africa have decided to improve on nature and establish the herring, a fish of the northern hemisphere, in the seas of the Union of South Africa. One often hears the expression "you can't improve on nature," but the fact is we are improving on nature all the time. All of the fruits, vegetables and field crops we grow in California have been improved by man from their original forms found in nature.

The shad, striped bass and soft-shelled clam were not by nature placed in California, but they have been established here by man. Captain Lambson, the modest but efficient superintendent of our Mount Shasta Hatchery, many years ago took king salmon eggs from California to New Zealand. There they were hatched and liberated in the streams, and now salmon are abundant in New Zealand streams where, apparently, the Lord never intended them to be. That is one of the things the genial captain will have to answer for.

If salmon can be taken from the northern hemisphere and established in the southern half of the world, why not herring? Herring spawn along the shore, where their eggs adhere firmly to the rocks and seaweed. These eggs would hatch in ordinary water temperature before they could be gotten to South Africa, but the hatching can be delayed by keeping them at a low temperature, just above freezing. The eggs must have oxygen, for they breathe as does every other living organism. The best way to ship the eggs will be to keep them in an ice chest where they are kept moist with salt water, and at the same time exposed to the air. Salmon and trout eggs are shipped that way, except that they are moistened with fresh water and the temperature need not be kept so low, as their period of incubation is much longer than that of herring eggs. The problem is entirely feasible, and South African herring may some time be as famous as Norway or Alaska herring, but that will not be during our lifetime.

It is also proposed to transplant the halibut from the north Atlantic to the seas of South Africa. This will be a more difficult task than transplanting the herring. The halibut inhabits deep water in the north Atlantic and the north Pacific. The fish are of such large size that it will be the young that will have to be used in the experiment. The young or developing eggs will be extremely hard to get, and if they are successfully gotten to South Africa and they make themselves at home, it will be a great many years before they can multiply to such an extent that they can be found or noticed, for a halibut does not mature and spawn until it is past twelve years of age. The success of the experiment would not be apparent until after several generations have been produced.—N. B. Scofield.

LOUISIANA SHRIMP INDUSTRY.

In the year 1921, 34,992,443 pounds of shrimps were caught in the state waters

of Louisiana—an increase of 50 per cent over the catch determined by the United States Bureau of Fisheries for the year 1916. The catch of 1921 had a value, to those engaged in the industry, of about three million dollars.

The principal cause of this great increase in the shrimp industry was the introduction of the otter shrimp trawl in 1917. In that year four of the trawls operated, and by 1921 the number had increased to 983. Beach seines, the only apparatus formerly used, decreased in number 50 per cent between 1916 and 1921. The seines could be operated only along shores, while the trawls could be operated in both shallow and deep water. Thus new fishing grounds were opened and it was found possible to avoid certain shallow waters at the times when young shrimps would be caught. There was a tendency among some of the fishermen, however, to catch young shrimps which were too small to market except they be dried, and to take them to the drying platforms. In spite of this abuse, the trawl is an improvement over the shrimp seine, from the standpoint of conservation, and in time, the catching of young shrimps can be prevented.

The history of the Louisiana shrimp industry is that of nearly all the larger fisheries. Great advances are caused by the introduction of improved and more efficient fishing apparatus. It appears, from the report of the Louisiana Department of Conservation, that the otter shrimp trawl is less destructive to young shrimps and to young fish than the shrimp seines.

The products of the commercial fisheries of Louisiana amount to about one-third that of the fisheries of California. The revenue which Louisiana derives from her fisheries in the way of licenses, fisheries tax and oyster ground rentals amounted to \$98,185.09 for the year ending December 31, 1923—a sum greater than that received by California from her much more extensive and more valuable fisheries.—N. B. Scofield.

PISMO CLAM CENSUS.

Members of the staff of the California State Fisheries Laboratory made the fifth annual census of Pismo clams at Pismo Beach on November 8-10, 1927. The purpose of this census, as in previous years, was to obtain data for an estimate of the total number of clams on the beach. Three trenches, located approximately a mile apart, were dug across the intertidal zone and a count made of all

clams found. The results of this year's census indicated even fewer clams on the beach than did last year's findings. No clams of legal size were obtained. The largest clam was less than four and one-half inches in diameter and only 15 per cent of the total exceeded three inches. The 1927 set of clams was apparently not as successful as the 1926 set, although it exceeded some of the poor sets of previous years. The very serious depletion of the clams on Pismo Beach was again demonstrated by this year's census, and unless the protective measures now in force are loyally supported by public sentiment, Pismo clams, if not entirely eliminated from our California beaches, will soon be practically unobtainable to both the amateur and the commercial digger.—Frances N. Clark, California State Fisheries Laboratory. November, 1927.

EUROPEAN BIOLOGICAL STATIONS.

While motoring through England this summer I had the good fortune to visit two places of interest to people in fisheries work—the Plymouth Marine Biological Station and the Ministry of Agriculture and Fisheries in London. The Plymouth Marine Biological Station was on our "itinerary" through this town of such great significance to Americans. We knew we had arrived on a special holiday, as evidenced by all the populace being in costume and grotesquely masked, and the streets being gaily decorated. After threading our way through the holiday traffic, we found our way up to the top of Citadel Hill. This is a part of the Hoe, the steep hill that lies between the town and the sea. The holiday crowd seemed to consider the Aquarium a place worthy of their attention, for many were paying the "tuppence" entrance fee to see the fish. After asking to see Dr. Allen, we were courteously presented to the genial director of the Biological Station. From his evident pleasure in showing us the whole institution he was certainly the true host.

I am afraid my memory of exact details may be faulty, but I believe there were individual laboratories for about forty research workers. A large aquarium room was equipped with all sorts of clever mechanical devices for duplicating ocean conditions. A separate building served as a class room for the special use of undergraduate classes that come occasionally from the different universities. The library, containing about ten thousand volumes, is rich in all the literature on fish and fisheries, besides having a good reference section in general biology.

In the aquarium Dr. Allen took pride in showing us the many kinds of fish, but especially the little species in the small tanks ingeniously lighted from above. They, with their dainty shapes and colors, were fully as interesting as the great undulating eels, darting bass, decorous cod, and gracefully soaring plaice. But best of all, our genial host took us out on the Hoe to "see" Sir Francis Drake's little fleet of vessels in the inner harbor; and the Green, a little distance away, where the admiral was playing at bowls when the Armada was first sighted. It was one of the thrills of a very interesting summer to stand there and look out across the sparkling bay to see in imagination the Spanish galleons sailing by, and Sir Francis himself, pausing in his game to gaze at the spectacle, for as we remember, he is said to have finished his game before putting out in pursuit.

In London I had the opportunity of visiting the Ministry of Agriculture and Fisheries. The room in which I waited to see Dr. E. R. Russell had little in it to suggest any connection with the sea except a model of a boat hauling a special sort of drag net. I was shown up three flights of very steep and winding stairs to the office of Dr. E. R. Russell, who received me in the gracefully courteous English way, and expressed his regret that the building was rather out of date, and had no elevator—to be exact it was three hundred years old—but that if people had the perseverance to search him out in his eyrie they deserved special consideration.

I must confess I was too poorly informed about the things I might have asked to talk intelligently. But now when I see the "Journal du Conseil Permanent International pour l'Exploration de la Mer," edited by E. R. Russell, it recalls a very interesting half hour in a building older than our own nation and a pleasant acquaintance with one of England's best known scientists.—Genevieve Corwin, Librarian, California State Fisheries Laboratory, October, 1927.

ABALONE SAFE FROM EXTERMINATION.

The laws protecting the abalone from commercial extermination are ideal, and it is not likely that the commercial abalone fishermen will exterminate or seriously deplete the abalone supply. The red abalone, which is the only one used commercially, is protected from amateurs by a seven-inch minimum limit. Red abalones which have reached this seven-inch limit have spawned at least three

times. At the request of commercial abalone fishermen, the minimum commercial size limit was fixed by the legislature at eight inches, and a red abalone has spawned at least six times before it reaches this eight-inch limit. Therefore, no commercial abalones are taken until they have spawned at least six times.

The red abalone is abundant in water deeper than the diver is able to go and to operate profitably. There is also an area in shallow water where the diver can not go on account of moving water which is outside the low tide line. Abalones in this area are not disturbed by the diver. The abalones, therefore, are protected so that they have ample opportunity to seed the rocks in the neighborhood where they spawn. If the commercial divers take all of the abalones which are eight inches or larger, they can not seriously deplete the supply because the law does not permit them to take them any smaller than that, and as has been shown, none of the abalones can be taken commercially until after they have spawned six times and there are many abalones which can not be taken by divers which spawn more than six times. The seven-inch abalone produces more than a million eggs. These eggs are fertilized in the open water and become a free swimming organism for several days before they settle down and attach themselves to the rocks; so that no matter whether the spawning abalones are in deep or shallow water, the young find their way to all places along the shore.

There is evidence that the young abalones, during the first two or three years of their lives, are more numerous in the deeper water and that these abalones move inshore later, in search of places where they may attach themselves to the rocks. This movement, however, takes place several years before they are of the size that may be taken commercially. Abalones, after they get to be five or six inches long, seldom permanently leave their places of attachment.

There has been a great deal of hysteria on the subject of abalone conservation. There is absolutely no reason why any region should object to taking abalones commercially. Not to take abalones for commercial purposes is wasting a valuable food supply without gaining anything.—N. B. Scofield.

TO SAVE THE FISHERIES OF THE GREAT LAKES.

For a number of years the yield of the Great Lakes fisheries has been declining, and just recently the lake herring fishery



FIG. 33 A fourteen pound northern halibut, *Hippoglossus hippoglossus*, taken southeast of Santa Rosa Island in 200 fathoms of water November 18, 1921, by the crew of a boat owned by K. Kuramoto.

has failed entirely. There is but little doubt that this has been caused by inadequate fishing regulations and wasteful fishing methods, although many of the fishermen blame the trouble on pollution of the water from cities and factories which turn their sewage and factory waste into the lakes. Besides Canada, there are eight states bordering on the lakes, and there has been poor cooperation between them in the way of regulations or investigations.

Realizing that coordinated action was necessary if the important fisheries of those waters were to be saved from destruction, Governor Green of Michigan called a conference of the interested fisheries officials. Besides the representatives of the eight states bordering on the lakes, there were present representatives of the Department of Marine and Fisheries of Canada and the Bureau of Fisheries of the United States. United States Commissioner of Fisheries Henry O'Malley was chosen chairman.

The convention approved a list of regulations which are to become effective when the states and Canada adopt them. These regulations would restrict the types of nets and fishing gear which can be used, prevent pollution of the waters, save the spawn of fish, taken by commercial fishermen, for the fish hatcheries, and have each state or government concerned adopt a system of gathering fisheries statistics similar to that used by California. To facilitate the adoption of

recommended regulations, it was urged that all the state fisheries commissions be given power by their legislatures to make and enforce fishing regulations.

This getting together of these eight states, Canada and the U. S. Bureau of Fisheries for the conservation of the Great Lakes fisheries is apparently an attempt to get the coordinated action of a group of states and another government, without resorting to the usual expedient of an international treaty where the states would lose jurisdiction over their own fisheries and that jurisdiction would be assumed by the central government.

Secretary of Commerce Herbert Hoover, under whose department comes the care of fisheries, through the Bureau of Fisheries, is on record as opposing the tendency of the states to turn over the regulation of the fisheries, electric power, etc., to the government. He states that this tendency is likely to make the central government top-heavy; leads to bureaucracy and tends to destroy local initiative. He has recommended that where a group of states have a common interest in fisheries, they form a coalition, with the sanction of congress, to handle their fisheries as a unit. This organization of the Great Lakes states is a move in this direction and it strikes us as a good move and one which may well be epoch-making. It also pleased us immensely to have this progressive group hold up our fisheries statistical program as an example to be followed.—N. B. Scofield.

LIFE HISTORY NOTES.

NORTHERN HALIBUT IN SOUTHERN CALIFORNIA.

On November 18, 1927, the fishing boat *Angel*, owned by K. Kuramoto and operating from San Pedro, brought into port a fourteen-pound northern halibut (*Hippoglossus hippoglossus*), which is pictured in the accompanying illustration. The specimen was caught on the southeast side of Santa Rosa Island in 100 fathoms.

So far as we have been able to find from the literature, the incident is remarkable in that it is the first time a northern halibut has ever been recorded in these waters. Jordan and Evermann (1898) give the Farallons as the southern limit of this species, and Starks (CALIFORNIA FISH AND GAME, 1918) gives Monterey Bay as the southernmost boundary. According to Mr. Mitchell Planchard of the Gilbert Van Camp market where the fish was delivered, this is the fourth northern halibut brought into

Van Camp's in the last two years.—L. A. Walford, California State Fisheries Laboratory, Terminal, California.

GRUNION AT LA JOLLA.

The two remarkable photographs here reproduced were sent to the Division of Fish and Game by Mr. Willis E. Zader of La Jolla. These were taken at La Jolla in April, 1927, and show grunion spawning in great numbers on the beach.

Grunion, as far as known, are the only fish that come out of the water and lay their eggs on what might be termed dry land, the sand of the beaches. This occurs during the favorable tides in the spring months of each year. On certain beaches, especially at Long Beach, vast crowds of people gather when the grunion are running and take these fish in great numbers. As a result, the grunion in waters adjacent to Los Angeles have become seriously depleted.

Mr. Zader writes that he has been observing the grunion at La Jolla for fifteen years, and as yet, can see little diminution in numbers, but feels that, unless protective measures are passed, these fish may be endangered. The illustrations show a much heavier run of fish than occurs at the present time on the beaches of Los Angeles County, although in past years the runs were as heavy as in the San Diego region.

A closed season is now in force which prohibits the taking of grunion during the months of April, May and June. It is hoped, as a result, that the grunion runs on the beaches in the Los Angeles region will increase and that the runs at La Jolla will continue in their present magnitude.—Frances N. Clark, California

where attempts will be made to develop a pure white strain.

Mr. Williams of Coalinga reports that one bird nearly white in color appeared in a litter of eight birds of normal parentage. This bird, now two years of age, had two litters of his own this year: one of nine and another of three. The birds of both litters have white feathers on breast, wings and backs, but are not as white as the father bird. The original parents had a litter of eleven birds that are all partly white. These birds have been feeding regularly near the home of Mr. Williams, but by the middle of November moved into the higher hills.—H. C. Bryant, Berkeley, California, November 23, 1927.



FIG. 34. Grunion spawning on the beach at La Jolla, California, April, 1927. Photograph by Willis E. Zader. Taken at 12.30 a.m.

Fisheries Laboratory, Terminal, California, October, 1927.

ALBINO QUAIL.

Albinism is likely to be found almost anywhere in animal life. Sometimes an albinistic variety can be developed by selective breeding. A pure white Java sparrow is imported in numbers; a faded-out variety of the shell parakeet is a common cage bird. Only one attempt so far as we know has been made to secure a pure white strain of the valley quail. Mr. H. R. Noack of Oakland for several years attempted to breed a pure white bird but without success.

This past fall a number of albinistic valley quail have been reported near Coalinga. Two albinistic forms were captured and sent to the state game farm

HUMPBACK SALMON TAKEN OFF SANTA MONICA.

The round haul boat *Victor Emanuel* on September 12, 1927, caught an apparently erratically wandering specimen of humpback salmon (*Oncorhynchus gorbuscha*) off Santa Monica, California. The specimen, a male, measures twenty-four and one-quarter inches long and weighs five pounds.

This part of California, we believe, is farther south than the humpback salmon has ever been recorded, the range as noted by Jordan and Evermann (1896), by Meek (1916) and by Messrs. Goode and Gill (1903), being the Pacific coast and rivers of North America and Asia from Oregon northward. Mr. N. B. Scofield in CALIFORNIA FISH AND GAME, January, 1916, records several specimens taken

from the San Lorenzo River, Santa Cruz County. These fish are occasionally taken in the Sacramento River where they are known as "lost salmon."—L. A. Walford, California State Fisheries Laboratory, Terminal, California, September 20, 1927.

WHITE-TAILED KITES NEAR HOLLISTER.

On November 27th, while watching a number of hawks along the dirt road between Gilroy and Hollister, I noticed perched on a fence post only fifty feet or so away a pearly gray and white hawk with black shoulders. Of course there is only one such colored hawk in California, the white-tailed kite. It sat there for some time, then sailed lightly away, only

The flight of this bird is very light and buoyant, but at times quite rapid. When compared with the similarly-sized prairie falcon, the flight of the kite is found to be indirect and carried at many changes of grade (slope of flight), at varying levels from the ground, while that of the falcon is direct, rapid, stiff-winged and carried at a steady level above the ground. The falcon is pale clay-brown above, white beneath with dark streaks and spots.

The adult male marsh hawk might be mistaken for the kite, or vice versa, but one good look at the white rump patch and bluish-gray tail with six to eight darker bands of the marsh hawk will distinguish it from the pure white tail of the kite.



FIG. 35. Grunion spawning on the beach at La Jolla, California, April, 1927. Photograph by Willis E. Zader. Taken at 1 a.m.

to stop and hover sparrow-hawk-like for a moment or so. For several minutes more I watched this bird, when suddenly from space another bird appeared and the two wheeled and turned back and forth over a small corner of one of the large fields.

My neck began to get tired following their flight, so I glanced across to the other side of the road and there were two more of the birds beating over a weed patch near an old well.

These birds were very busy hunting, but only once did I see them actually catch anything, apparently a frog or a small toad. On a number of occasions they were seen to drop to the ground only to resume flight almost instantly with nothing showing in their claws or bill.

Their flight is often quite similar, both beating back and forth over fields and marshy ground. The kite hovers more often than the marsh hawk.

The kite is so reduced in numbers that the birds can not be taken even as scientific specimens by collectors. It is to be hoped that the species is on its way back to somewhere near its former numbers.—D. D. McLean, Berkeley, California.

ACORNS AS A DUCK FOOD.

While skinning three confiscated wood ducks, *Aix sponsa*, from Maxwell, California, I discovered in the gullets several acorns of the valley oak, *Quercus lobata*. In one of the male birds I found three acorns in the gullet. The stomach had been removed. In the second male bird

there were five acorns in the gullet. The stomach had also been removed. The female bird had two acorns in its gullet. These acorns average an inch and three-quarters in length and nearly three-quarters of an inch in diameter. The largest was an inch and seven-eighths long and seven-eighths of an inch through. Imagine how the bird must have to stretch its throat and the gigantic gape it must open in order to swallow the nuts.—D. D. McLean, Berkeley, California.

BIRDS AND GRAPES.

During the last two months many complaints have come in from various sources against several species of birds. These complaints are all similar in that the birds are accused of eating grapes.

On the whole most of the birds accused are those unprotected by the state law, namely, the linnet or house finch and the English sparrow. The California or valley quail, golden-crowned and gambel white-crowned sparrows are accused of damage and also blacklisted by some men.

Several places were visited during October and a careful survey made of each situation. Two places near Morgan Hill were visited where linnets were doing 90 per cent of the damage, with California quail and golden-crowned sparrows doing the remainder.

Mr. Reeves, at Paicines, was practically cleaned out by California quail. He had trained his vines rather low and consequently the quail, which is a ground feeder, had nearly annihilated his crop. He would not shoot them because he felt he was breaking the law. Just across the road from his place, on another man's land, is a large thicket of brush which is a veritable harbor for quail and brush rabbits. Mr. Reeves made an offer to the other gentleman to clear out the thicket for the wood, but was refused. Consequently he has suffered. In the trip through the vineyard with him on October 20, the work of linnets, golden-crowned sparrows and quail was very apparent. Brush rabbits and cottontail rabbits had done considerable damage to the young shoots and also had apparently done some damage to the grapes themselves.

On November 3 and 4, I was on the east side of the San Joaquin Valley, near Porterville, Lindsay and Exeter. The damage done by linnets and English sparrows there has been prodigious.

Mr. Baier has a number of plots aggre-

gating several thousand acres in that vicinity. On one of the smaller places, comprising about eighty acres, he estimated his loss last year conservatively at \$30,000, while the three largest places showed an aggregate loss of between \$75,000 and \$80,000.

Red Emperor grapes are valued at about \$2,500 per car. When one figures that before the birds became a pest, Mr. Baier hired twenty pickers and they turned out five carloads a day, while last year and this year he hired sixty pickers and they scarcely averaged two cars per day the loss is apparent. Pickers are paid approximately 40 cents an hour.

A bunch of grapes unpecked by birds will only take from two to four seconds to pick and place in the lug box, while the pecked bunches take on an average of from fourteen to sixteen seconds, the slowest recorded sixty-three seconds. Two-thirds of the pickers' time is easily spent in clipping pecked grapes from the bunches and inspecting the bunches in search for them. The bunches must also be inspected in the packing house, wasting another seven or eight seconds.

Mr. Baier spent \$5,000 for ammunition at the beginning of the 1927 season.

Approximately seventy stomachs of birds were examined for grape pulp, seeds and juice. The following species were represented: linnet, gambel white-crowned sparrow, golden-crowned sparrow, audubon warbler, willow goldfinch, chipping sparrow, English sparrow, western Savannah sparrow, lark sparrow, red-shafted flicker, valley quail and western mockingbird. From this examination only two species were found to be a really serious menace, the linnet and English sparrow. Three others were found to be consistent eaters of grapes, the gambel white-crowned sparrow, golden-crowned sparrow and red-shafted flicker. But since they are not present in hordes, their damage is but slight.

The remainder of the list were present in the vineyards, but were only eating weed seeds, grass seeds and insects.

From this evidence it can be seen that here is an important economic problem. In cooperation with Mr. Baier I am now trying to find a solution by which the destruction can be curbed without menacing all the birds present, since most of the species are a benefit to the vineyard and only five species mentioned are really a menace.—D. D. McLean, Berkeley, California, Nov. 30, 1927.

CONSERVATION IN OTHER STATES.

MAINE OPENS SEASON ON MOOSE.

Although Minnesota has permanently closed the season on moose and although the animal is practically extinct over most of its range, the state of Maine is trying the experiment of a fall open season of six days in eight of the counties of the state. This is the first time in many years that any moose hunting has been available to sportsmen of the United States proper, and it may be that this is the last moose hunting that will be available for many years to come, dependent, of course, on the results of this experiment.

KANSAS AFTER WILDFOWL REFUGE.

The Cheyenne bottoms and depression of approximately one hundred square miles and lying in the heart of the state of Kansas, having been flooded by heavy rains, has drawn attention to this area as a possible wildfowl refuge. Reports are to the effect that this inundated area has attracted more ducks than had been known in the vicinity for more than twenty years. Many sportsmen are saying that even though the cost of the land would be a million dollars, the Cheyenne bottoms are worth it. Here is another interest where the state finds the project too great to accomplish by itself. Federal authorities have, therefore, been urged to consider ways and means of giving the middle west a fine refuge for waterfowl.

MISSOURI INCREASES WARDEN FORCE.

Missouri Game and Fish Department has announced an extended protective program. The warden force, which had but twenty-five men, has been nearly doubled. The state has been divided into three divisions, each in charge of a field warden, and each field warden directs the work of twelve regular wardens. The whole force is under the direction of a chief of wardens. Thus has attention been given to the necessity for thorough supervision and the patrol of a definite territory. The announcement states that though the chief object of the reorganization is a stricter enforcement of the game and fish laws, it is intended that at least one-half of the time of the wardens will be directed to educational work. It is recognized that an awakened public consciousness is the greatest asset that the cause of conservation can have.

NEW MEXICO UNDERTAKES FISHING WATER SURVEY.

An investigation was recently launched in New Mexico for the purpose of securing information on the following points:

- (1) The location and magnitude of each water supporting or possibly capable of supporting fish.
- (2) Their capacity for supporting fish life.
- (3) The kind of fishes best adapted to them.
- (4) Their accessibility to man.

With this information at hand, the kinds of fish that will best thrive in various waters can be determined. A summary of the total mileage of fish supporting streams is 2037, that of lakes, 63,913.

Two pertinent paragraphs in the report are worth quoting:

"To the average man, if a stream fails to provide good fishing the remedy is to stock it. If the fishing still remains poor—stock it more heavily. It is amazing the number of people who are firm in the conviction that the only thing that prevents a water from delivering up to the eager angler an unlimited number of fish is an insufficient amount of stocking. The same man who would recognize an evidence of stark lunacy in an attempt to raise a thousand head of steers on a quarter-section of range, will generally quite cheerfully dump a thousand fingerlings into a section of stream having the same relative amount of food, with a child-like faith that by some miraculous process they will somehow be transmuted into legal size fish by next spring.

"The factors which enter into the capacity of a water to support fish, and the determination of the most suitable species, are many and diverse, and all must be reckoned with if a reasonably accurate estimate is to be made. And when it is realized that many of these factors are still far from being perfectly understood, it will be appreciated how difficult it is to say with any degree of certainty 'this number of this species of fish must be planted in this mile of water per year to obtain best results.' However, the knowledge we have is far better than pure guesswork, and will go a long way toward securing a more equitable distribution of the product of our hatcheries."

NEW BIRD REFUGE IN FLORIDA.

By recent executive order, the President has transferred from the War Department to the Department of Agriculture as a refuge for birds a portion of the Fort Matanzas Military Reservation in the state of Florida. The area consists of a group of marsh islands lying in the Matanzas River about 15 miles south of St. Augustine, Florida, and serves as a nesting place for wild fowl, chiefly terns. Shearwaters nest in the vicinity and possibly occupy some portions of the reserved area. The administration of the new refuge is placed under the Bureau of Biological Survey.

NEW ZEALAND USES EDUCATIONAL METHOD.

As indicative of the strong belief in educational work as a means of furthering conservation, reference can be made to New Zealand. A recent report states that several hundred projecting machines and several million feet of film have been accumulated. The proper apparatus is loaned to various schools on the theory that "one good picture in fifteen minutes makes a more lasting impression than several books with several weeks utilized in learning their contents."

MOUNTAIN SHEEP SUCCESSFULLY INTRODUCED IN MONTANA.

In 1922 the Bureau of Biological Survey liberated twelve mountain sheep on the National Bison Range in Montana. A reduction of the predatory animals was then obtained. The sheep have now increased to sixty-nine. Thus has been demonstrated the fact that it is possible to successfully introduce this wariest of game animals in suitable areas. Success attained here suggests the possibility of reestablishing the big horn in the higher mountains of California.

SPECIAL LICENSE NEEDED TO KILL BEAR IN NEW MEXICO.

New Mexico has changed the status of the black bear from an unprotected predatory animal to that of a big game mammal with special protection afforded it. The open season is placed from October 10 to October 31 and the bag limit is one per season. A hunter must have a big game license costing residents \$3 and non-residents \$25.25 before he can kill a bear. Many states need to follow New Mexico's example.

AUXILIARY GAME REFUGES FOR MISSOURI.

Missouri following the passing of the Auxiliary Game Refuge Bill by the legislature, and following the example of Pennsylvania, is soliciting the cooperation of its sportsmen in the establishment of auxiliary game refuges in every district in the state. These auxiliary refuges differ from regular game refuges in that the latter are on state-owned lands and the former are on lands of others and leased for periods of not less than ten years. Blanks giving printed requirements and conditions under which these refuges may be established are made available through the State Department, but no application will be considered if the private lands covered are not connected with public hunting grounds, it being the intent of the state to have the sites amply large for public hunting in addition to the refuge proper. —Missouri Game and Fish News, July, 1927.

Pennsylvania has a system of auxiliary refuges based on a written agreement with the owner of the property. In the fall of 1926 there were sixty-five of them located in forty-three different counties totaling about 90,000 acres. These auxiliary refuges differ from the large permanent refuges only in size and in that there is no resident refuge keeper. They are under the supervision of a district game protector.

LOST FISH RECEIPT BOOKS.

During the year 1926 three of our fish receipt books were lost on a barge operating at Point Reyes, and when the barge was again placed in service in 1927 these books were recovered.

These books show that 106,065 pounds of salmon, 6336 pounds of crabs (264 dozen), 97 pounds of rock cod, 95 pounds of halibut and 693 pounds of codfish were received on this barge in 1926, but this amount of fish does not appear on our report of the catch for San Francisco for 1926, as the records were made up and published before these books were found.

Dealers should use every precaution to see that fish receipt books which they have are turned in, so we may have a complete record of the catch. Receipt books are seldom lost, but in this case a considerable commercial catch of fish does not appear in our records.

REPORT ON SARDINE CANNERIES 1926-27.

The first canning operations in Monterey for 1927 started in August, and all canneries except one ceased operation in March. Canning operations were started in the San Pedro district in November and continued into May. In San Diego, packing was carried on throughout the year, but on a small scale, and less than fifteen thousand cases of all size cans were packed.

The following table shows the production at Monterey and San Pedro districts. One plant was operated in northern California outside of Monterey and the output is included in the Monterey figures.

CANNERY, FISH FLOUR, MEAL AND OIL PRODUCTION.

Season June 1, 1926, to May 31, 1927.

District	Tons fish received	Tons fish used for canning	Tons fish used for meal and flour
Monterey.....	79,343	60,941	18,318
San Pedro.....	64,216	52,324	11,892
Totals.....	143,559	113,265	30,210
Deduct fish used for other purposes.....	8,165		
Fish used by canning plants.....	140,394		

District	Tons offal	Cases 1-lb. ovals packed	Cases other size cans packed	Other size cans equivalent to cases 1-lb. ovals	Cases per ton	Tons flour
Monterey.....	20,306	1,202,516	39,134	21,673	16.1	184
San Pedro.....	17,441	986,858	52,561	63,264	16.3	
Totals.....	37,747	2,189,374	91,695	84,937		
Add other sizes.....		84,937				
Equal to cases 1-lb. ovals.....		2,274,311				

District	Meal, tons	Ratio per ton meal	Oil, gallons	Gallons oil per ton of offal and fish	Tons fish used for other purposes
Monterey.....	6,675	5.6	1,562,351	40.4	3,165
San Pedro.....	5,962	4.9	682,796	23.3	
Totals.....	12,637		2,245,147		3,165

TABLE OF CASE PRODUCTION, RATIO OF MEAL AND OIL PRODUCTION.

Name of plant	Location	Kind of plant	Number of cases 1-lb. oval cans per ton	Ratio per ton of meal	Gallons of oil per ton of offal and fish
Bayside Fish Flour Company	Monterey	Fish flour	-----	6.4	44.8
F. E. Booth Company	Monterey	Cannery	16.9	5.3	42.4
California Packing Corporation	Monterey	Cannery	15.8	5	43.6
Carmel Canning Company	Monterey	Cannery	16.9	5.9	40.5
E. B. Gross Canning Company	Monterey	Cannery	15.1	5	43.6
K. Hovden Company	Monterey	Cannery	16.8	6.2	47
Monterey Canning Company	Monterey	Cannery	14.7	6.4	29.2
San Carlos Canning Company	Monterey	Cannery	15	4.8	40.7
San Xavier Packing Company	Monterey	Cannery	15.3	6	35
Sea Pride Canning Company	Monterey	Cannery	15	6.4	30
Coast Fishing Company	Wilmington	Cannery	17.2	4.7	18.1
Franco-Italian Packing Company	East San Pedro	Cannery	14.1	5.5	30.4
French Sardine Company	East San Pedro	Cannery	18.1	5	24
General Fisheries	San Pedro	Cannery	6.4	4.8	33.3
Italian Food Products Company	Long Beach	Cannery	16.3	7.8	23.5
Los Angeles Sea Food Company	East San Pedro	Cannery	14.3	4.8	23.4
Kittling-Joerissen Canning Company	East San Pedro	Cannery	16.4	4.2	17
Southern California Fish Corporation	East San Pedro	Cannery	17.5	4.7	20.6
Seacoast Packing Company	East San Pedro	Cannery	17.3	5.5	16.5
Stafford Packing Company	Wilmington	Cannery	13.8	3.7	28.7
Toyo Fisheries	Wilmington	Cannery	16.6	4.7	19
Van Camp Sea Food Corporation	East San Pedro	Cannery	16.4	5	25.5

¹Includes operation of Pittsburg plant.

The percentages shown for various plants are based on sworn reports furnished by each plant, and same method used for all plants to arrive at above ratios.

The following table shows case pack, meal and oil production for calendar years 1916 to 1926.

1-Lb. Ovals.

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	97,100	2,512	7,133	106,745
1917	331,065	43,221	34,380	408,666
1918	593,315	136,632	17,790	747,737
1919	798,566	113,909	33,594	946,069
1920	687,777	213,714	50,302	951,793
1921	287,954	77,048	1,189	366,191
1922	353,188	340,860	3,595	697,643
1923	580,464	488,885	19,215	1,088,564
1924	631,286	693,133	12,135	1,336,554
1925	737,743	920,191	29,846	1,687,780
1926	1,158,133	861,088	63,410	2,082,631

Fish Meal, Tons.

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	249	261	25	535
1917	875	2,606	-----	3,481
1918	2,874	4,737	1,123	8,734
1919	3,812	5,667	1,874	11,153
1920	3,969	3,328	1,559	8,856
1921	2,115	3,566	636	6,317
1922	2,695	5,373	959	9,027
1923	3,806	4,216	1,216	9,238
1924	6,601	7,726	1,001	15,328
1925	7,105	13,023	2,808	22,936
1926	7,307	7,066	1,394	15,767

Includes all meal produced.

Fish Oil, Gallons.

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916.....	25,563		500	26,063
1917.....	92,393	83,900		176,293
1918.....	261,466	67,858	17,400	346,724
1919.....	341,173	146,298	26,791	514,262
1920.....	419,474	152,937	39,174	611,585
1921.....	226,826	93,305	16,607	336,738
1922.....	285,858	244,310	6,882	547,050
1923.....	576,553	346,883	28,452	951,888
1924.....	1,240,296	1,059,001	51,425	2,350,722
1925.....	1,246,561	1,715,633	187,847	3,150,041
1926.....	1,418,512	651,006	54,410	2,123,928

Includes all fish oil produced.

For quick reference and comparison of activities in the Monterey and San Pedro districts, a chart is given below showing receipts of sardines, number of cases packed on basis of 1-lb. oval cans, number of tons of meal and gallons of oil produced.

DISTRICTS		40 M.	80 M.	
SARDINE RECEIPTS	MONTEREY			79343 TONS
	SAN PEDRO			64216 TONS
		400 M.	800 M.	1200 M.
CASES PACKED BASIS ONE POUND OVALS	MONTEREY			1224189 CASES
	SAN PEDRO			1050122 CASES
		4 M.	8 M.	
MEAL PRODUCTION	MONTEREY			6675 TONS
	SAN PEDRO			5962 TONS
		400 M.	800 M.	1200 M.
OIL PRODUCTION	MONTEREY			1562351 GALS
	SAN PEDRO			682796 GALS

FIG. 36. Receipts of sardines in various districts of California, season 1927.

REPORTS.

GAME CASES.

July, August, September, 1927.

Violation	Number arrests	Fines imposed	Jail sentences (days)
Hunting License Act	104	\$2,375	140
Deer Tag License Act	42	1,550	100
Deer: closed season or district	22	1,625	290
Deer: does, fawns, spiked bucks, forked horn bucks in District 1½	51	4,075	270
Deer: over limit	6		
Deer: failure to produce horns or hide	11	400	
Deer: running with dogs, closed season	2	25	
Ducks: closed season	17	500	30
Doves: closed season	36	1,010	
Doves: over limit	11	400	
Sage hens: over limit	3	100	
Pheasants: closed season	1	100	
Quail: closed season	39	1,625	
Pigeons: closed season	3	25	50
Non-game birds	12	290	
Rabbits: cottontail-brush: closed season	60	1,295	140
Squirrels, tree: closed season	1	25	
Shooting game from automobile	5	100	
Trespass	1	25	
Night hunting	12	475	
Game refuges: hunting, possession of firearms	15	175	150
Totals	454	\$16,195	1,170

FISH CASES.

July, August, September, 1927.

Violation	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act	31	\$660	38
Commercial Fishing License Act	36	505	
Trout: over limit	16		
Trout: taken other than with hook and line	3	25	15
Striped bass: undersized and over limit	27	960	
Striped bass: sale of, in closed season	1	20	
Crabs: undersized	1		
Crabs: closed season	2	20	
Clams: undersized and over limit	27	790	25
Abalones: undersized and over limit	17	495	
Abalones: drying, illegal	1		
Lobsters: closed season	1	25	
Barracuda: undersized	5	225	
Black bass: undersized	14	330	
Illegal fishing: withing 300 feet of inlet to lake; 250 feet fishway; 150 feet lower side dam	8	150	
Illegal possession of fish spear	2	70	
Nets: illegal possession or use	12	1,000	
Pollution	6	1,000	
Totals	210	\$6,820	78

SEIZURES OF FISH AND GAME.

July, August, September, 1927.

Salmon, pounds	7,000
Spot fin croaker, pounds	620
Barracuda, pounds	5,000
Striped bass, pounds	503
Sunfish	26
Black bass	166
Trout	477
Perch	15
Crabs	48
Clams	755
Abalone	18
Lobsters, pounds	50
Quail	105
Pheasant	3
Dove	395
Sage hen	27
Ducks	114
Band-tailed pigeons	7
Nongame birds	37
Deer meat, pounds	3,401
Deer hides and horns	5
Illegal nets and traps	5

STATEMENT OF INCOME.

For the Period July 1, 1927, to September 30, 1927, of the Seventy-ninth Fiscal Year.

License sales:	Detail	Total
Angling licenses—1927	\$61,978 00	
Hunting licenses—1926-27	11,014 70	
Hunting licenses—1927-28	43,295 00	
Market fishermen's licenses—1927-28	19,400 00	
Wholesale fish packers and shell fish dealers'—1926-27	30 00	
Wholesale fish packers and shell fish dealers'—1927-28	920 00	
Game breeders' licenses—1927	40 00	
Fish breeders' licenses—1927	15 00	
Trapping licenses—1927-28	380 00	
Commercial hunting club licenses—1927-28	275 00	
Commercial hunting club operators' licenses—1927-28	75 00	
Deer tag licenses—1927	23,332 00	
Total license sales		\$160,754 70
Other income:		
Game tag sales	\$7 50	
Court fines	12,121 32	
Fish packers' tax	8,485 73	
Kelp tax	6 26	
Fish tag sales	1,368 61	
Interest on bank deposits	642 50	
Total other income		22,631 92
Total income		\$183,386 62

STATEMENT OF EXPENDITURES.

For the Period July 1, 1927, to September 30, 1927, of the Seventy-ninth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Executive and legal	\$5 50	\$3,765 00	\$259 68	\$1 75	\$4,031 93
Clerical and office	391 72	5,145 00	772 85	447 54	6,757 11
Rent			2,724 38		2,724 38
Automobiles	62 47		42 10	6 95	111 52
Telephone and telegraph			1,006 68		1,006 68
Postage			1,230 90		1,230 90
Freight, cartage and express			837 97		837 97
Printing	5,894 35		393 75		5,894 35
Accident and death claims			34 45		34 45
Commissioners					
Total administration	\$6,354 04	\$8,910 00	\$7,302 76	\$456 24	\$23,023 04
Education:					
Director	\$114 52	\$2,691 93	\$344 73	\$1,248 23	\$4,399 41
Publicity:					
Director		\$825 00	\$299 23		\$1,124 23
State fair	\$237 28	597 50	624 93	\$18 45	1,478 16
Total publicity	\$237 28	\$1,422 50	\$924 16	\$18 45	\$2,602 39
Conservation and protection:					
Chief and assistants		\$3,054 99	\$301 96		\$3,356 95
Clerical and office	\$39 35	992 07	8 80	\$180 34	1,220 56
Rent			98 46		98 46
Automobiles	323 76		97 80	2,736 90	3,158 46
Captains and deputies	25 50	43,321 07	38,984 39	379 06	82,710 02
Patrol launches	359 20	525 00	44 65		928 85
Lion hunting		450 00	285 78		735 78
Lion bounties			1,020 00		1,020 00
Fish planting	102 17	1,346 00	781 82	136 49	2,366 48
Refuge posting	98 18	575 48	200 82	432 27	1,306 75
Total conservation and protection	\$948 16	\$50,264 61	\$41,824 48	\$3,865 06	\$96,902 31
Commercial fisheries:					
Chief and assistant	\$14 26	\$2,634 99	\$675 57	\$12 73	\$3,337 55
Deputies	7 07	5,338 07	1,217 79		6,562 93
Patrol launches	534 97	1,170 00	132 80	72 91	1,910 68
Statistical	4 55	1,395 00	68 45		1,468 00
Laboratory	181 86	8,360 48	1,097 12	266 46	9,905 92
Salmon tagging			214 50		214 50
Botulism			3,760 00		3,750 00
Automobiles	152 59		57 25		209 84
Total commercial fisheries	\$895 30	\$18,898 54	\$7,213 48	\$352 10	\$27,359 42
Fish culture:					
Chief and assistant		\$999 99	\$16 25	\$10 00	\$1,026 24
Clerical and office	\$34 36	1,015 50	6 80		1,056 66
Rent			84 00		84 00
Automobiles	937 03		683 38	4,638 72	6,259 13
Hatcheries	21,445 83	30,708 28	4,727 64	4,189 87	61,071 62
Hatchery additions and betterments				1,663 83	1,663 83
Special field investigation		2,635 00	505 80		3,140 80
Total fish culture	\$22,417 22	\$35,358 77	\$6,023 87	\$10,502 42	\$74,302 28
Hydraulics:					
Chief and assistant	\$3 52	\$1,305 00	\$833 99		\$2,142 51
Game propagation:					
Game farm	\$1,639 55	\$2,220 00	\$571 37	\$71 05	\$4,501 97
License commissions			\$11,922 50		\$11,922 50
Research:					
Director	\$13 33	\$1,644 00	\$182 50		\$1,839 83
Total expenditures	\$32,622 92	\$122,715 35	\$77,143 84	\$16,513 55	\$248,995 66

CORRECTION.

In the January, February and March report of the catch of fish in California, published in the July, 1927, Vol. 13, No. 3, issue of CALIFORNIA FISH AND GAME, pages 229 and 230, the following corrections should be made:

Alameda-Contra Costa counties should read:

Perch	644
Salmon	6,559
Shad	894
Shad—Buck	97,138
Shad—Roe	84,802
Striped bass	110,525
Total fish	317,595
Total	326,840

San Francisco-San Mateo counties should read:

Cultus cod	76,889
Rockfish	265,399
Sablefish	80,993
Salmon	572
Total fish	4,559,011
Crabs	1,026,888
Total	5,891,022

Footnote No. 4, showing number of dozens of crabs should read 42,787 dozen.

To correct the total catch for the state, the following amounts should be added to the totals for California, pages 231 and 232:

Cultus cod	873
Perch	11
Rockfish	1,721
Sablefish	126
Salmon	643
Shad	69
Shad—Buck	2,310
Shad—Roe	2,107
Striped bass	2,544
Crabs	14,040

Footnote No. 1, page 232, should read 47,245 dozen.

These corrections were made on account of delayed reports having reached this office after the original report was made up for publication.

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JULY, AUGUST AND SEPTEMBER, 1927.
Compiled by Division of Fish and Game, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt.....	Mendocino, Sonoma, Lake....	Marin.....	Solano, Yolo.....	Sacramento, San Joaquin.....	Alameda, Contra Costa....	San Francisco, San Mateo.....	Santa Cruz.....	Monterey.....
Albacore.....							153,080	218	2,390
Anchovies.....									2,594
Baracuda.....								1,731	
Bonito.....									
Carp.....				523	1,425	6,912			
Catfish.....		5,060		4,546	36,746	23,881			
Cultus Cod.....		34,083					100,682	19,281	8,577
Flounders.....		4,210					55,525	74,740	900
Grayfish.....							8,475	6,625	
Hake.....							27,895	8,602	
Halibut.....	249,013	37,029					3,648	571	4,783
Kingfish.....							26,056	24,686	424
Mackerel.....								1,049	332,393
Mackerel—Horse.....									7,640
Mullet.....							21,708	7,774	8,683
Perch.....	3,648		1,640	6	30	23			
Pike.....									
Pompano.....									
Rock Bass.....							185,109	155,789	198,149
Rockfish.....	27,637	4,435					175,069	55,833	1,458
Sablefish.....	86,159	12,638					1,342,826	97,517	37,705
Salmon.....	694,951	1,271,027		168,806	191,938	272,634	149,280	104,132	710
Sardines.....		390					6,361,490	565	85,853,447
Sardines.....	168							507	
Southern.....									
Sea Bass—Black.....									
Sea Bass—White.....							4,615	36,243	6,266
Shad.....				311	249	10,080			
Shad—Buck.....					44	1,263			
Shad—Roe.....					12				
Sheepshead.....									
States.....							22,185	14,145	2,503
Stripjack.....								998	
Smelt.....	5,388	100	3,729			58	10,746	55,935	55,932

Sole.....	4,045	4,680				58	1,851,303	701,891	69,976
Spittail.....						131,655	859		
Striped Bass.....			2,724	15,735	13,936				
Swordfish.....							315		
Tomcod.....									
Tuna—Bluefin.....									
Tuna—Yellowfin.....									
Turbot.....			1,374						
Whitebait.....						15	4,113		79
Whitefish.....	17,232								
Yellowtail.....									
Miscellaneous.....	1,355			155		48	8,627	198	1,897
Total fish.....	1,098,451	1,373,662	23,224	188,082	244,380	451,627	10,513,606	1,349,030	86,565,396
Crustaceans:									
Crabs.....									
Shrimps.....	120,880		365,864				33,672	57,056	
Mollusks:							179,702		
Abalone.....									
Claus—Cookie.....	86,000								
Claus—Mixed.....		673	867						
Claus—Pismo.....	1,202	292	4,609						827,425
Claus—Softshell.....									
Cuttlefish.....			12,960			13,475	11,309		
Mussels.....							623	58	11,940
Oysters—Eastern.....			213,485				431,581		360
Squid.....								14,700	37,883
Totals.....	1,206,533	1,374,627	420,009	188,082	244,380	465,102	10,740,493	1,370,844	87,444,004

All amounts shown in pounds. Albacore and skipjack cleaned.

1 870 dozen.

2 56,750 shell oysters.

3 153 dozen.

4 143,550 shell oysters.

5 294 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JULY, AUGUST AND SEPTEMBER, 1927—Continued.

Compiled by Division of Fish and Game, Department of Commercial Fisheries.

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican, brought into California via San Pedro	Mexican, brought into California via San Diego	Total Mexican brought into California
Albacore		3,198,672	8,849	700,162	3,897,683	23,047	100,922	123,969
Anchovies		650			156,338			156,338
Barracuda	13,698	1,285,218	2,030	286,612	1,590,152		56,097	56,097
Bonito	309	483,801	867	315,135	801,843		1,043	1,043
Carp					8,860			8,860
Catfish					75,233			75,233
Cultus Cod	171				171,661			171,661
Flounders		1,134			136,529			136,529
Grayfish		22,118	20	167	37,385			37,385
Hake					36,497			36,497
Halibut		44,207	51	12,205	447,577			447,577
Kingfish	96,070	25,752		2,745	79,663			79,663
Mackerel	5,972	490,077	7,585	66,656	903,642			903,642
Mackerel—Horse		111,584			119,224			119,224
Mullet		5,018	413	3,900	9,331			9,331
Perch	406	20,174	823	1,508	66,364			66,364
Pike					59			59
Pompano		283		451	734			734
Rock Bass	2,201	92,109	20,851	65,588	180,749			180,749
Rockfish	29,825	102,355	3,589	129,109	805,997		358	358
Sablefish	40				311,197			311,197
Salmon	21				4,077,425			4,077,425
Sandake		3,113			237,625			237,625
Sardines	672	552,231		270,072	93,038,645			93,038,645
Sculpin	35	13,784	130	14,326	28,782			28,782
Sea Bass—Black	865	6,381	3,513	74,687	85,446		44,186	44,186
Sea Bass—White	21,875	210,774	1,231	68,251	363,012		347,690	347,690
Shad					10,640			10,640
Shad—Buck					1,307			1,307
Shad—Roe					12			12
Sheepshead	110	7,144	58	4,013	11,325			11,325
Skates		2,950			41,783			41,783
Striped Bass		4,069,213	1,939	999,953	5,071,935			5,071,935
Striped Bass—Smelt	12,046	86,648	32,552	2,320	8,523,087		8,541,729	8,541,729
Smelt					265,680			265,680

Sole.....	\$9,411	5,793	3	2,723,197		
Spiral.....				163,849		
Striped Bass.....				103,275		
Swanfish.....		3,831		815		
Tomcod.....				3,137,378		79
Tuna—Bluefin.....		2,518,154	765	318,689		
Tuna—Yellowfin.....		137,821	45	42,856		
Turbot.....				1,374		
Whitefish.....				21,489		
Whiting.....	75	6,626		31,886		
Yellowtail.....	20	187,317	411	740,699		
Miscellaneous.....	283	35,315	204	9,087		414,598
Total fish.....	271,105	14,021,237	85,924	12,153,623		24,910,934
Crustaceans:						
Crawls.....						
Shrimps.....						
Mollusks:						
Avalones.....				431,608		
Clams—Cockle.....	4,088			545,560		
Clams—Mixed.....				917,518		
Clams—Purlo.....				1,540		
Clams—Softshell.....	20,171			6,103		
Cuttiefish.....				20,171		
Mussels.....	96			37,744		
Oysters—Eastern.....				12,717		
Squid.....				360		
Totals.....	295,460	14,021,237	85,924	122,097,996		24,910,934

5 1,317 dozen.
7 200,300 shell oysters.

PATROL SERVICE.

K. P. ALLRED, Acting Chief of Patrol	San Francisco
M. S. Clark, Assistant Chief of Patrol for Northern California	San Francisco
C. S. Bauder, Assistant Chief of Patrol for Southern California	Los Angeles
O. P. Brownlow, Captain, In Charge Fish Planting	San Francisco
Walter Welch, Captain, In Charge Volunteer Wardens	San Francisco
Earl P. Barnes	Eureka
T. M. Benson	Fortuna
H. E. Black	San Luis Obispo
S. R. Briggs	Hollister
C. L. Bundock	San Francisco Office
J. L. Bundock	Oakland
Jack Burke	Daly City
F. A. Burke	King City
T. K. Duncan	Concord
C. E. Holladay	Morgan Hill
I. L. Koppel	San Jose
G. O. Laws	Weaverville
Taylor London	Requa
McPherson Lough	Eureka
R. C. Marshall	Douglas City
E. V. Moody	Santa Cruz
Ralph Newsome	Monterey
Fred H. Post	Salinas
H. S. Prescott	Crescent City
J. P. Vissiere	Watsonville
LA RUE CHAPPELL	Pasadena
E. H. OBER	Big Pine
W. E. Adkinson	El Toro
R. E. Bedwell	Ventura
E. A. Chan	Santa Ana
A. F. Crocker	Big Pine
C. S. Donham	Mecca
Walter Emerick	Ventura
E. H. Glidden	San Diego
J. H. Gyger	Perris
W. L. Hare	Owensmouth
R. J. Little	Banning
S. H. Lyons	Solvang
W. C. Malone	San Bernardino
D. R. Oliver	Lone Pine
E. D. Ricketts	Brawley
R. J. Sadler	Venice
Carmi Savage	Ontario
W. S. Talbott	Los Angeles
C. L. Towers	Los Angeles
Webb Toms	San Diego
J. W. Thornburg	Thermal
Albert Veil	Escondido
C. J. Walters	Independence
D. E. ROBERTS	Sacramento Office
G. I. Fleckenstein	Folsom
Euell Gray	Placerville
R. C. O'Connor	Grass Valley
Nelson Poole	Sacramento Office
C. Sibeck	Sacramento Office
R. L. Sinkey	Woodland
A. H. Willard	Rocklin
WM. LIPPINCOTT	Yreka
Ray Diamond	Orleans
J. F. French	Fall River Mills
S. R. Gilloon	Mt. Shasta
F. A. Greene	Redding
B. L. Hammack	Fort Jones
A. A. Jordan	Alturas
Fred R. Starr	Macdoel
S. J. CARPENTER	Maxwell
R. W. Anderson	Orland
Harry N. Brittan	Red Bluff
L. W. Dinsdale	Maxwell
Albert Sears	Maxwell
J. V. Shearin	Stonyford
A. J. Stanley	Chico
Geo. Thompson	Gridley
J. D. DONDERO	Lakeport
E. R. Caldwell	Covelo
Ovid Holmes	Fort Bragg
J. H. Hellard	Willits
G. N. Johnson	Napa
E. F. Macklin	Ukiah
K. J. Ransdell	Middletown
HENRY LENCIONI	Santa Rosa
J. H. Groves	Cloverdale
V. E. Von Arx	Sebastopol
W. B. SELLMER	Fairfax
Wm. Armstrong	Vallejo
Lee Atkinson	Crockett
C. M. Bouton	San Rafael
C. F. England	San Rafael
R. James Yates	San Rafael
JOSEPH H. SANDERS	Truckee
C. J. Barnes	Portola
C. O. Fisher	Susanville
W. I. Long	Westwood
A. Miner	Quincy
Oscar Schumaker	Truckee
J. E. NEWSOME	Newman
W. C. Blewett	Los Banos
C. L. Brown	Mariposa
C. L. Gourley	Gustine
L. W. Longeway	Sonora
Geo. Magladry	Modesto
H. I. Pritchard	Atwater
Geo. R. Smalley	Madera
JOHN O'CONNELL	Stockton
W. J. Black	Jackson
Wm. Hoppe	Walnut Grove
Bert Laws	Rio Vista
Geo. Pickering	San Andreas
E. W. SMALLEY	Hanford
A. R. Ainsworth	Taft
L. Arnold	Bakersfield
F. A. Bullard	Dunlap
R. J. Bullard	Visalia
Ray Ellis	Fresno
W. T. Smalley	Porterville
C. R. Taylor	Coalinga
C. B. Tibbets	Kernville

LAUNCH PATROL.

W. B. SELLMER, In Charge	Fairfax
C. M. Bouton	Launch "Quinnat," San Rafael
Wm. Armstrong	Launch "Hunter," Vallejo

STATE LION HUNTER.

Jay C. Bruce	San Lorenzo
--------------	-------------

Captains indicated in capitals.

CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1928
